Refine Search

Search Results -

Terms	Documents
L17 and ((location$ or region$ or zone or area) near2 service)	5

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L18

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Sunday, May 15, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L18	L17 and ((location$ or region$ or zone or area) near2 service)	5	L18
L17	L15 and map$ and gps$	15	L17
L16	L15 and map$.clsm	0	L16
L15	L1 and (differential near2 location$)	22	L15
	DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L14	l6 and l9	11	L14
	DB=USPT,USOC; THES=ASSIGNEE; PLUR=YES; OP=OR		
L13	L11 and different$	1	L13
	DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L12	L11 and differential$	0	L12
	DB=USPT,USOC; THES=ASSIGNEE; PLUR=YES; OP=OR		
L11	6526351.pn.	1	L11
	DB=PGPB,USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L10	L9 and map$.clm.	1	L10

L9	L5 and ((location$ or region$ or zone or area) near2 service)	20	L9
L8	L7 and ((location$ or region$ or zone or area) near2 service)	1	L8
L7	L5 and map$.clm.	10	L7
L6	L5 and map$	42	L6
L5	L2 and (different$ adj information)	64	L5
L4	L3 and (current$ near3 (location or address or point))	9	L4
L3	L2 and map$.clm.	20	L3
L2	L1 and (different$ adj2 information).clm. and location$	141	L2
L1	gps$ and (different$ adj2 information) and @ad<=20031211	1407	L1

END OF SEARCH HISTORY

Hit List

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 5 of 5 returned.

☐ 1. Document ID: US 20050059410 A1

L18: Entry 1 of 5 File: PGPB Mar 17, 2005

PGPUB-DOCUMENT-NUMBER: 20050059410
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050059410 A1

TITLE: System and method for providing differential location services

PUBLICATION-DATE: March 17, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Trossen, Dirk	Cambridge	MA	US	
Pavel, Dana	Cambridge	MA	US	

US-CL-CURRENT: 455/456.1; 455/414.2

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 2. Document ID: US 20040066330 A1

L18: Entry 2 of 5 File: PGPB Apr 8, 2004

PGPUB-DOCUMENT-NUMBER: 20040066330
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040066330 A1

TITLE: Vehicle information system

PUBLICATION-DATE: April 8, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Knockeart, Ronald P.	Clarkston	MI	US	
Drury, Bob	Novi	MI	US	
Rode, Melvin A.	Orion	MI	US	
Brown, Steven	Sterling Heights	MI	US	
Asher, Harry	Garden City	MI	US	
Jozefowicz, Paul A.	Roseville	MI	US	

US-CL-CURRENT: 342/357.07; 340/466, 340/936

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

---

☐ 3. Document ID: US 20040064245 A1

L18: Entry 3 of 5 File: PGPB Apr 1, 2004

PGPUB-DOCUMENT-NUMBER: 20040064245
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040064245 A1

TITLE: Vehicle information system

PUBLICATION-DATE: April 1, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Knockeart, Ronald P.	Clarkston	MI	US	
Drury, Bob	Novi	MI	US	
Rode, Melvin A.	Orion	MI	US	
Brown, Steven	Sterling Heights	MI	US	
Asher, Harry	Garden City	MI	US	
Jozefowicz, Paul A.	Roseville	MI	US	

US-CL-CURRENT: 701/210; 340/995.19, 701/117

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. De

---

☐ 4. Document ID: US 20030055553 A1

L18: Entry 4 of 5 File: PGPB Mar 20, 2003

PGPUB-DOCUMENT-NUMBER: 20030055553
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030055553 A1

TITLE: Vehicle information system

PUBLICATION-DATE: March 20, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Knockeart, Ronald P.	Clarkston	MI	US	
Drury, Bob	Novi	MI	US	
Rode, Melvin A.	Orion	MI	US	
Brown, Steven	Sterling Heights	MI	US	
Asher, Harry	Garden City	MI	US	
Jozefowicz, Paul A.	Roseville	MI	US	

US-CL-CURRENT: 701/120; 701/213

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

---

☐ 5. Document ID: US 6628233 B2

L18: Entry 5 of 5 File: USPT Sep 30, 2003

US-PAT-NO: 6628233

DOCUMENT-IDENTIFIER: US 6628233 B2

TITLE: Vehicle information system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

---

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L17 and ((location$ or region$ or zone or area) near2 service)	5

Display Format: [-] Change Format

Previous Page Next Page Go to Doc#

L4: Entry 1 of 9 File: PGPB Nov 11, 2004

DOCUMENT-IDENTIFIER: US 20040225432 A1
TITLE: Method and system for the navigation and control of vehicles at an airport and in the surrounding airspace

Abstract Paragraph:
A navigation and airport control and management method and system for aircraft and surface vehicles. The system incorporates the use of differential GPS to provide increased accuracy and robustness for aircraft and vehicles using GPS as the primary terminal area navigation system. An antenna is precisely located and identified with GPS compatible coordinate references. GPS signals are received with the antenna and supplied to a differential GPS base station. The base station calculates psuedorange and delta range corrections for each tracked satellite. Calculated differential corrections are then broadcast to vehicles in the local area using a radio transmitter. Vehicles receive the broadcast differential corrections and calculate differentially corrected position, velocity and time (PVT) information. This information is used on aboard the vehicle for navigational or automatic dependent surveillance purposes. At an airport control and management system ADS broadcasts are received and used for control purposes.

Abstract Paragraph:
The construction of precise digital maps compatible with GPS is used for vehicle onboard navigation and for air traffic control situation display purposes. The digital maps include airport features such as runways, taxiways, gate areas, geographical features nearby the airport and other pieces of useful in formation.

Application Filing Date:
20031211

Cross Reference to Related Applications Paragraph:
[0001] This invention is a Continuation of application Ser. No. 09/871,328 filing date May 31, 2001 currently pending, which is a Divisional Application of application Ser. No. 09/598,001 filing date Jun. 20, 2000 now U.S. Pat. No. 6,314,363, which is Divisional Application of application Ser. No. 09/032,313 filing date Feb. 27, 1998 now U.S. Pat. No. 6,195,609, and is a continuation in part of application Ser. No. 08/651,837, filed May 21, 1996 now U.S. Pat. No. 5,740,047, and is Divisional Application of application Ser. No. 08/524,081 filing date Sep. 6, 1995 now U.S. Pat. No. 5,867,804, from Document Disclosure # 360870 dated Sep. 2, 1994, Book "GPS Based Airport Operations, Requirements, Algorithms and Analysis, Publication Date Sep. 14, 1994, Copyright Registration Nov. 10, 1994, and is a continuation in part of Ser. No. 08/117,920 filed Sep. 7, 1993 now U.S. Pat. No. 5,548,515, which is a continuation of application Ser. No. 08/117,920 filed Sep. 7, 1993 now U.S. Pat. No. 5,548,515, which is a continuation in part of Ser. No 07/758,852 filed Sep. 12, 1991 abandon, and a continuation in part of Ser. No. 07/659,681 Jun. 9. 1992 abandon, which is the US national phase of PCT/US-91/07575 filed Oct. 9, 1991 abandon, which is a continuation in part of Ser. No. 07/758,852 filed Sep. 12, 1991 abandon, which is a continuation in part of Ser. No. 07/593,214 filed Oct. 9, 1990 now U.S. Pat. No. 5,200,902.

Summary of Invention Paragraph:
[0003] The use of GNSS in the airport environment plays an important role in the

navigation and control of vehicles comprised of aircraft and surface equipment. To meet the accuracy and integrity of demanding airport navigation and control operations, differential GNSS is used. Differential GNSS reference receivers located at precise GNSS surveyed locations provide differential corrections over an RF datalink to differential GNSS capable receivers located aboard vehicles. Two Federal Aviation Administration programs build on this demonstrated technique of the applicant, specifically the Wide Area Augmentation System and the Local Area Augmentation System. Supporting the navigation function, descriptive digital maps indicative of airport surrounding terrain and airport physical features are used in the vehicles for navigation and by air traffic controllers for the control of airport operations. In uncontrolled airports without controllers the pilot and vehicle operators control their movement independently using differential GNSS navigation.

Summary of Invention Paragraph:
[0016] Others are also demonstrating and developing similar systems in prior years included: Haken Lans (GP&C) of Sweden is demonstrating the use of Differential GPS with Self Organizing Time Division Multiple Access datalink communications. The invention of Haken Lans is described in World Intellectual Property Organization document # 93/01576. The invention of Fraughton describes an airborne system for collision avoidance in U.S. Pat. No. 5,153,836. The inventions of Lans and Fraughton fail to provide the seamless 4 dimensional GNSS compatible operational and processing environment of Pilley and fail to include the digital map of Pilley.

Summary of Invention Paragraph:
[0019] GPS BASED AIRPORT OPERATIONS, Requirements, Analysis, Algorithms US copyright # TX U.S. Pat. No. 3,926,573, (Library of Congress # 94-69078), (ISBN 0-9643568-0-5). This bookprovides much of the back ground for this patent application. In addition to the book the following publications and professional papers have been published by the inventor in efforts of due diligence to promote this life saving technology.

Summary of Invention Paragraph:
[0021] Institute of Navigation, ION GPS-91, Sep. 12, 1991, Technical Paper, "Airport Navigation and Surveillance Using GPS and ADS".

Summary of Invention Paragraph:
[0022] GPS WORLD Magazine, 10-91, Article, "GPS, Aviation and Airports the Integrated Solution".

Summary of Invention Paragraph:
[0024] Institute of Navigation National Technical Meeting, Jan. 28, 1992, Technical Paper, "Terminal Area Surveillance Using GPS".

Summary of Invention Paragraph:
[0025] Institute of Navigation, ION GPS-92, Technical Paper, "Collision Prediction and Avoidance Using Enhanced GPS".

Summary of Invention Paragraph:
[0026] Institute of Navigation, 49th Annual Meeting, June 1993, Technical Paper, "Runway Incursion Avoidance Using GPS".

Summary of Invention Paragraph:
[0029] IEEE Vehicle Navigation and Intelligent Vehicle (VNIS), Conference, Oct. 14, 1993, Technical Paper, "Demonstration Results of GPS for Airport Surface Control and Management". Institute of Navigation, ION GPS-93, Sep. 23, 1993, Technical Paper,

Summary of Invention Paragraph:

[0030] "GPS for Airport Surface Guidance and Traffic Management". Avionics Magazine, 10-93, "Differential GPS Runway Navigation System Demonstrated".

Summary of Invention Paragraph:
[0031] IEEE PLANS '94, April 1994, Technical Paper, "GPS, 3-D Maps and ADS Provide A Seamless Airport Control and Management Environment".

Summary of Invention Paragraph:
[0032] Institute of Navigation, ION GPS-94, Sep. 22, 1994, Technical Paper, "DGPS for Seamless Airport Operations".

Summary of Invention Paragraph:
[0033] Presentation Seattle, Washington, May 9, 1995. International Civil Aviation Organization of the United Nations, Advanced Surface Movement Guidance and Control (SMGCS) meeting, Presentation and demonstration "GPS based SMGCS".

Summary of Invention Paragraph:
[0040] This invention most generally is a system and a method for the control of surface and airborne traffic within a defined space envelope. GNSS-based, or GPS based data is used to define and create a 3-dimensional map, define locations, to compute trajectories, speeds, velocities, static and dynamic regions and spaces or volumes (zones) including zones identified as forbidden zones. Databases are also created, which are compatible with the GNSS data. Some of these databases may contain, vehicle information such as type and shape, static zones including zones specific to vehicle type which are forbidden to the type of vehicle, notice to airmen (notams) characterized by the information or GNSS data. The GNSS data in combination with the databases is used, for example, by air traffic control, to control and manage the flow of traffic approaching and departing the airport and the control of the flow of surface vehicles and taxiing aircraft. All or a selected group of vehicles may have GNSS receivers. Additionally, all or a selected group may have bi-directional digital data and voice communications between vehicles and also with air traffic control. All of the data is made compatible for display on a screen or selected screens for use and observation including screens located on selected vehicles and aircraft. Vehicle/aircraft data may be compatibly superimposed with the 3-dimensional map data and the combination of data displayed or displayable may be manipulated to provide selected viewing. The selected viewing may be in the form of choice of the line of observation, the viewing may be by layers based upon the data and the objective for the use of the data.

Brief Description of Drawings Paragraph:
[0082] FIG. 11 depicts a waypoint processing diagram showing the earth and ECEF coordinate system, expanded view of airport waypoints, further expanded view of previous and next waypoint geometry with present position, the cross hair display presentation used in the developed GPS navigator

Brief Description of Drawings Paragraph:
[0088] FIG. 17 shows a missed approach followed by a touch and go GPS trajectory displayed in a 3-D airport map

Brief Description of Drawings Paragraph:
[0091] FIG. 20 depicts the GPS sliding cross hair landing display indicating too low (go up) and too far right (turn left)

Brief Description of Drawings Paragraph:
[0092] FIG. 21 illustrates the GPS approach cone with digital map elements showing current position with respect to true course line

Brief Description of Drawings Paragraph:
[0103] FIG. 32 depicts the differential GPS system diagram

Brief Description of Drawings Paragraph:
[0104] FIG. 33 depicts the closed loop differential GPS system diagram

Detail Description Paragraph:
[0111] More specifically, each vehicle 8 supports the capability to transmit a minimum of an identifier, the GNSS referenced position of one or more antennas, velocity, optional acceleration and time reports. Since this data is broadcast, it is accessible to the airport control tower, other aircraft and vehicles in the local area, and various airline monitoring or emergency command centers which may perform similar processing functions. ATC commands, processed by the Controller/Operator Interface 6 and Operational Control 1 function are passed to the Real Time Communication Handler 3 for transmission to the aircraft/vehicle(s) 8. Upon receipt of ATC messages, the vehicle(s) 8 return an acknowledgment message which is received by the Real Time communication Handler 3 and passed to the Operational Control 1 function. Differential GNSS corrections are generated by the Differential GPS Processor 4 and passed to the Real Time Communication Handler 3 for broadcast to the vehicles. The Real Time Communication Handler 8 performs the following functions at a minimum:

Detail Description Paragraph:
[0355] The ECEF X,Y,Z position fields provide the vehicle's position at the time of the ADS transmission in ECEF X,Y,Z coordinates. The position is calculated by the GPS receiver. Based on the system design, these values may or may not be smoothed to compensate for system latencies. The message length of 10 characters provides a sign bit in the most significant digit and 9 digits of positional accuracy. The least significant digit represents 0.1 meter resolution. This provides a maximum ADS distance of +9999999.9 which translates to an altitude of about 3600 KM above the earth's surface, providing sufficient coverage to support low earth orbiting satellites and spacecraft.

Detail Description Paragraph:
[0357] Delta positions are used to represent the positional offset of two other GPS antenna locations. These locations can be used to determine the attitude of the aircraft or its orientation when it is not moving. All delta distances are calculated with respect to the current ECEF position. Straight forward ECEF vector processing may then be used to determine the attitude and orientation of the aircraft with respect to the ECEF coordinate frame. An ECEF-to-local on board coordinate system (ie. North, East, Up) conversion may be performed if necessary. Accurate cross wind information can be determined on the ground and on board the aircraft from delta position information. Delta positions may also be used as 3-D graphical handles for map display presentations.

Detail Description Paragraph:
[0360] The fields represent the A/V's ECEF X,Y,Z velocity in meters per second. Tenth of a meter/second resolution is required during the ground phase of GPS based movement detection, latency compensation, zone and collision detection processing.

Detail Description Paragraph:
[0365] This field identifies the Universal Coordinated Time at the time of the ADS transmission. This time is the GPS derived UTC time (in seconds) plus any latency due to processing delays (optional).

Detail Description Paragraph:
[0366] The ADS message format provides a very valuable set of information that simplifies mathematical processing. Since the ECEF cartesian coordinate frame is native to every GPS receiver, no additional GPS burden is incurred. This type of ADS broadcast message information is more than adequate for precision ground and air operations as well as for general ATC/airport control and management functions.

Detail Description Paragraph:
[0369] The Mode S system is in use today and is compatible with today's en route radar and Terminal Radar Approach Control (TRACON)-based air traffic control systems. Current Mode S 1030 MHZ interrogation is performed using Mode S radars which scan at the 4.8 second rate. The scan rate represents the rotational period of the scanning antenna. When a target is interrogated by the radar pulse, the aircraft or vehicle broadcasts its GPS-based information to air traffic control at 1090 MHZ. In this manner, ADS information is received by ATC and by other interrogating sources.

Detail Description Paragraph:
[0372] Mode S Squitter (GPS Squitter)

Detail Description Paragraph:
[0373] Similarly, the Mode S squitter utilizes the Mode S frequencies. A squitter is a randomly timed broadcast which is rebroadcast periodically. The Mode S squitter broadcasts GPS information at a periodic rate at 1090 MHZ with a bit rate of 1 MBPS. Current thinking requires that the ADS system be compatible with the Traffic Collision Avoidance System (TCAS). The TCAS system currently uses a 56 bit squitter message that must be turned off in the low altitude airport environment since it will interfere with other radar processing activities performed on the ground. Turning TCAS off inside the terminal area (where most midair problems and airport surface collisions occur) defeats the system's operational benefits where they are needed most. Operationally this is unacceptable.

Detail Description Paragraph:
[0374] A modified 112 bit squitter message has been proposed by MIT Lincoln Laboratories. With this approach, the GPS data is squittered twice per second to support ground and low altitude operations. The proposed Mode S squitter operation has distinct advantages over the Mode S interrogation method. Broadcasts are generated from all aircraft and (potentially) surface vehicles. Message collisions are possible, especially when the number of users is increased. If a collision occurs, the current message is lost and one must wait for the next message to be transmitted. At a two hertz transmission rate, this is not a significant problem. Analysis performed by MIT Lincoln Laboratories indicates that an enhanced Mode S squitter has potential to support operations at major airports.

Detail Description Paragraph:
[0378] AVPAC radio is currently in use with services provided by ARINC and may be a viable candidate to provide ADS services. Again, a GPS-based squitter or an interrogator-initiated broadcast is utilized at aeronautical VHF frequencies. Work is underway to adapt AVPAC to support both voice and data transmissions. A Carrier Sense Multiple Access (CSMA) protocol is utilized on multiple VHF frequencies

Detail Description Paragraph:
[0382] An interesting communication scheme currently under test and development in Sweden utilizes TDMA operation. TDMA is similar to communication technologies used by the United States military and others. In this system, each user is assigned a slot time in which to broadcast the ADS message. A single or multiple frequency system may be utilized based upon total traffic in the area. Upon entering an airport area, the user equipment listens to all slot traffic. The user equipment then selects an unused broadcast time slot. Precise GPS time is used to determine the precise slot. ADS broadcasts are then transmitted at a periodic rate. Broadcasts typically repeat at one second intervals. Should a collision be detected upon entering a new location, the system then transmits on another clear time slot. Since all time slots are continuously received and monitored, all necessary information for situational awareness and collision avoidance is available.

Detail Description Paragraph:
[0383] This system maximizes the efficiency of the broadcast link since, in a

steady state environment, no transmission collisions can occur. A time guard band is required to assure that starting and ending transmissions do not overlap. The size of the guard band is a function of GPS time accuracy and propagation delay effects between various users of the system. Another feature of this system is an auto-ranging function to the received broadcasts. This is possible due to the fact that the ADS slot transmissions are defined to occur at precise time intervals. It is then possible, using a GNSS synchronized precise time source, to determine the transit time of the ADS broadcast. By multiplying the speed of light by the transit time, one may calculate the 1-dimensional range to the transmitting object. In reality, a more precise direction, distance and predicted future location is obtainable from the ADS message information itself.

Detail Description Paragraph:
[0385] CDMA spread spectrum ADS broadcasts utilize a transmission format similar to that used in the GPS satellites. PRN codes are utilized to uniquely identify the sending message from other messages. The number of users able to simultaneously utilize an existing channel depends upon the PRN codes used and the resulting cross correlation function between the codes. This implementation is being utilized commercially in wireless computer systems with data rates exceeding 256 KBPS. In a frequency agile environment, this implementation may be able to provide secure ADS services.

Detail Description Paragraph:
[0395] From a simplicity standpoint, the ECEF coordinate frame provides direct GPS compatibility with minimal processing overhead. The system is based upon the ECEF world wide coordinate frame and provides for 4-D gate-to-gate navigation without local coordinate reference complications. Furthermore, it is directly compatible with zone processing functions as described in earlier sections.

Detail Description Paragraph:
[0397] Three dimensional display graphics, merged with GPS sensor inputs, provide exciting new tools for airport navigation, control and management. Today's airport users operate in a 4-dimensional environment as precisely scheduled operations become increasingly important in an expansion-constrained aviation system. The 4-D capability of GPS integrated with precise 3-D airport maps and computer graphics, provide seamless airport safety and capacity enhancements. The merger of these technologies provides precise, real-time, 3-D situational awareness capability to both the A/V operators and the air traffic controller.

Detail Description Paragraph:
[0398] The FIG. 17 shows a missed approach 81 on runway 35 followed by a touch and go 82 on runway 24 at the Manchester Airport. The power of such a situation display 83 presentation for the air traffic controller can be instantly recognized. Upon closer inspection, it becomes increasingly clear that GPS and precise graphical maps can be a valuable asset in air and ground navigation.

Detail Description Paragraph:
[0401] The integration of GPS-based navigation information with digital maps suggests that new methods of navigation processing should be considered. In the past, aircraft typically relied on a signal in space for instrument-based navigation. The instrument landing system (ILS) consists of a localized directed signal of azimuth and elevation. The VOR-DME navigation system uses a signal in space which radiates from an antenna located at a particular latitude and longitude. Altitude is determined from pressure altitude. Current, 2-D radar surveillance systems are also based upon a localized coordinate reference, usually to the center of the radar antenna. Again, altitude information is from barometric pressure readings which vary with weather. The integration of localized navigation and surveillance systems and 3-D ATC and navigational display presentations require an excessive number of coordinate conversions, making the process overly difficult and inaccurate.

Detail Description Paragraph:
[0402] To minimize navigational and display overhead, a Cartesian X,Y,Z coordinate system is used for the navigation computations, map database and display presentations. Many X,Y,Z map database formats are in use today, but many are generated as a 2-D projection with altitude measured above mean sea level. Two examples of this type of system are Universal Transverse Mercator (UTM) and State Plane Coordinate System (SPCS). Neither one of these systems is continuous around the world, each suffer from discontinuities and scale deformity. Furthermore, neither of these systems is directly compatible with GPS and also requires coordinate conversions. If the map, travel path waypoints, navigational processing, navigational screen graphics and airport control and management functions are in the Cartesian coordinate frame, the overall processing is greatly simplified.

Detail Description Paragraph:
[0403] In the graphical navigation display FIG. 18, the perspective is that of a pilot from behind his current GPS position 84. From this vantage point 85, the pilot can view his current position 84 and his planned travel path 86. As the aircraft moves, its precise ECEF X,Y,Z velocity 87 components are used to determine how far back 88 and in what direction the observation is conducted from. This is determined by taking the current ECEF velocity 87, negating it and multiplying it by a programmable time value (step-back time). When applied to the aircraft's current position 84, this results in an observation point 89 which is always looking at the current position 84 and ahead in the direction of travel 87.

Detail Description Paragraph:
[0404] Once the observation point 89 is established in the 3-D Cartesian coordinate system, an imaginary mathematical focal plane 90 is established containing the current position 84. The focal plane 90 is orthogonal to the GPS-derived ECEF velocity vector 87. The mathematical focal plane 90 represents the imaginary surface where the navigation `insert` 91 will be presented. The focal plane is always, by definition, orthogonal to the viewing point 85. The travel path 86 composed of ECEF X,Y,Z waypoints (92-95) is drawn into the 3-dimensional map. The point on the true travel path 86 which is perpendicular to the current position 84 represents the center 96 of the navigational insert screen 91. The orientation of the navigational insert with respect to the horizontal axis is determined by the roll of the aircraft. The roll may be determined through the use of multiple GPS antennas located at known points on the aircraft or may be determined by inertial sensors and then converted to the ECEF coordinate frame. Vector mathematics performed in the ECEF coordinate frame are then used to determine the new rotated coordinates of the navigation screen insert 91. The rotated coordinates are then translated through the use of the graphical translation matrix and drawn into the 3-D map 97.

Detail Description Paragraph:
[0405] The final step is the placement of the current position `cross-hair` symbol 84 with respect to travel path 86. The aircraft's GPS position, previous and next waypoints are used to determine the ECEF cross track vector 98. The cross track vector 98 is then broken down into its local vertical 99 and local lateral 100 (horizontal) components. (Local components must be used here since the vertical and lateral vectors change as a function of location on the earth.) The cross-hair symbol 101 is then drawn on to the focal (image) plane 90 surface at the proper offset from the true course position indicated by the center of the navigation screen insert 96. Thus, this display provides precise navigation information (lateral and vertical distance to true course) with respect to true course, provides information on 3-D airport features and shows the planned 3-D travel path. The element of time may also be presented in this display format as an arrow (drawn in the direction of travel) of variable length where the length indicates speed up or slow down information.

Detail Description Paragraph:
GPS Navigator Display

Detail Description Paragraph:
[0407] Various display formats are used to provide the GPS navigational information to the pilot. The area navigation display shown in FIG. 19 features auto-scaling range 102 rings 103 which provide course, 104 bearing 105 and range distance to the waypoint. The length of the course 104 and bearing lines 105 superimposed on the ring scale 103 are proportional to the distance from the waypoint. The compass orientation of the bearing line 105 provide the course to travel from the current position to the waypoint. The course line 104 indicates the compass direction of current travel. The display also provides altitude information as a auto-scaling bar chart display 106 with indicated go up or down information.

Detail Description Paragraph:
[0413] The GPS landing display is shown in FIG. 20. This display is activated when the first GPS waypoint at the top of the glide slope is reached. The precision landing display is composed of a simple heavy cross 107 which moved about on an X Y graticuled cross hair display 108. Textual TURN LEFT/TURN RIGHT and GO UP/GO DOWN messages are presented to the pilot when the aircraft is more than a predetermined amount eg. 10.0 meters off of true course.

Detail Description Paragraph:
[0415] The cone is sliced at the point on the line (formed by the current and previous waypoint) perpendicular to the present position 112. The resulting cross section then effectively represents the cross hair symbology implemented in the graphical GPS landing display. The current position is then displayed within the conical cross section 113 of the glide slope zone 109. A position not in the center of the display means the aircraft is not on true course. For example, a position report in the upper right of the display cross section means the aircraft is too high and too far to the right. In this case the pilot should turn left and go down. As the aircraft gets closer to the touch down point, the conical cross section scale gets smaller. Once the touchdown waypoint 114 is reached, the display reverts to a plan view of the airport similar to that shown in FIG. 8 which is then used for surface navigation. The graphical nature of this display format is useful in the air and on the ground, but requires very fast graphical and computational performance. The advantage of this system is that it minimizes many of the navigational calculations such as cross track errors, but requires moderate spatial graphical computations and fast display performance.

Detail Description Paragraph:
[0432] The processing of data communications within the airport is a key element of any GPS-based airport control and management system. A minimum of three types of messages must be addressed:

Detail Description Paragraph:
[0433] (1) the broadcast of Differential GPS correction messages to the vehicles

Detail Description Paragraph:
[0438] Differential GPS Overview

Detail Description Paragraph:
[0439] Real time differential correction techniques compensate for a number of error sources inherent to GPS.

Detail Description Paragraph:
[0440] The idea is simple in concept and basically incorporates two or more GPS receivers, one acting as a stationary base station 118 and the other(s) acting as roving receiver(s) 119, 120. The differential base station is "anchored" at a known point on the earth's surface. The base station receives the satellite signals,

determines the errors in the signals and then calculates corrections to remove the errors. The corrections are then broadcast to the roving receivers.

Detail Description Paragraph:
[0442] Through the implementation of local differential GPS techniques, SA errors are reduced significantly while the atmospheric errors are almost completely removed. Ephemeris and clock errors are virtually removed as well.

Detail Description Paragraph:
[0444] A site survey of potential differential base station sites should be performed to determine a suitable location for the GPS antenna. The location should have a clear view of the sky and should not be located near potentially reflective surfaces (within about 300 meters). The antenna site should be away from potentially interfering radiation sources such as radio, television, radar and communications transmitters. After a suitable site is determined, a GPS survey should be conducted to determine the precise location of the GPS antenna--preferably to centimeter level accuracy. This should be performed using survey grade GPS equipment.

Detail Description Paragraph:
[0445] Survey grade GPS equipment makes use of the 19 and 21 centimeter wavelength of the L1 and L2 GPS transmissions. Real time kinematic or post processing GPS surveys may be conducted. Real time kinematic utilizes a base station located at a precise location which broadcasts carrier phase correction and processing data to a radio receiver and processing computer. Code, carrier integral cycles and carrier phase information are used at the survey site to calculate the WGS 84 antenna position. In the post processing survey mode, subframe information, time, code, carrier, and carrier phase data are collected for a period of time. This data is later post processed using precise ephemerides which are available from a network of international GPS sites. The collected information is then post processed with post-fit precise orbital information.

Detail Description Paragraph:
[0447] The precisely surveyed location of the GPS antenna is programmed into the reference station as part of its initial installation and set up procedures. Industry standard reference stations determine pseudo range and delta range based on carrier smoothed measurements for all satellites in view. Since the exact ECEF position of the antenna is known, corrections may be generated for the pseudo range and delta range measurements and precise time can be calculated.

Detail Description Paragraph:
[0449] As shown previously in FIG. 22 the DGPS correction messages are broadcast by the reference station and received by the roving receivers. The corrections are applied directly to the differential GPS receiver. The DGPS receiver calculates the pseudo range and the delta range measurements for each satellite in the usual manner. Prior to performing the navigation solution, the received pseudo range and delta range corrections are applied to the internal measurements. The receiver then calculates corrected position, velocity and time data.

Detail Description Paragraph:
[0450] Since differential GPS eliminates most GPS errors, it provides significant improvements in system reliability for life critical airport operations. Short term and long term drift of the satellite orbits, clocks and naturally occurring phenomenon are compensated for by differential GPS as are other potential GPS satellite failures. Differential GPS is mandatory in the airport environment from a reliability, accuracy and fault compensating perspective.

Detail Description Paragraph:
[0451] As with autonomous GPS receiver operation, multipath is a potential problem. The differential reference station cannot correct for multipath errors at the

roving receiver(s). Antenna design and placement considerations, and receiver design characteristics remain the best solutions to date in the minimization of multipath effects.

Detail Description Paragraph:
[0455] On board each vehicle, the GPS-based position and velocity data is converted to Earth Centered Earth Fixed (ECEF) coordinates for use in the navigation and zone processing algorithms if necessary. For simplicity, this format is used in the ADS transmission as well. Upon receipt of an ADS message, the AC&M Processor 115 forwards the message to the COMM Processor 116 then stores the data in the vehicle database. The stored ECEF position and velocity data is used to perform collision prediction, zone incursion, lighting control and navigation processing at the AC&M station.

Detail Description Paragraph:
[0572] 3. Upon selection of the desired view, the AC&M map display is redrawn. AIRPORT LIGHTS: the system also demonstrates the capability to control; airport lights based on GPS inputs and current clearance status.

Detail Description Paragraph:
[0575] A vehicle database is maintained by the AC&M and on board `fully equipped` vehicles to provide a situational awareness capability to the controller and/or vehicle operator. GPS-based situational awareness requires the integration of a datalink between the aircraft, surface vehicles and the AC&M system. In the demonstration prototype system, the position and velocity information determined on board each vehicle is broadcase over and experimental VHF datalink and received by the AC&M. At the AC&M, the message is assembled into a dynamic vehicle database. As each ADS message is received, the following fields in the vehicle database are updated:

Detail Description Paragraph:
[0587] As ADS messages are received, collision prediction processing is performed using the current GPS data and the information stored in the vehicle database. The following database fields are used in the collision prediction processing:

Detail Description Paragraph:
[0700] Differential GPS data is provided by a GPS GOLD DGPS receiver 124 and a differential data link 125. GPS position, velocity, and time information is supplied to the dual 486 based processing unit. The first 486 processor, or Navigation (NAV) Processor 126, receives GPS Receiver 124 information and performs the following functions:

Detail Description Paragraph:
[0719] Again, differential GPS data is provided by a DGPS receiver 131 and a differential data link 132. GPS position, velocity, and time information are supplied to the dual 486 based processing unit. The first 486 processor, the Navigation Processor (NAV) 133, receives GPS information and performs the following functions:

Detail Description Paragraph:
[0740] Since no graphic display is provided on Vehicle #2, a single 386-based processor 137 is utilized. Again, differential GPS data is provided by an on board DGPS receiver 138 and a differential data link 139. GPS position, velocity, and time information is supplied to the 386 based processing unit 137 which performs the following functions:

Detail Description Paragraph:
[0749] Each vehicle is equipped with a VHF/UHF radio capable of full duplex communications. The radio interfaces to an integrated modem/GPS interface card. The radio modem is used to receive differential corrections, ADS messages, and ATC

command messages forwarded by the COMM Processor. Local GPS messages are received by the vehicle's Navigation (NAV) processor. The GPS position and velocity data is converted to the ECEF coordinate frame, reformatted and transmitted to the AC&M Processor over the same radio.

Detail Description Paragraph:
[0761] As the ADS messages are received, they are parsed and stored in the local vehicle database. Collision processing is performed each second, upon receipt of the FEV's GPS position and velocity data. After each GPS update, projections are performed on the FEV's current position and compared to the projected positions for each vehicle stored in the local database. In the same manner as described for the AC&M Processor, potential collision watch and warning conditions are detected between the FEV and other vehicles. However, collisions between two remote vehicles are not detected. Collisions tests are only performed with respect to the FEV itself and those in its vicinity.

Detail Description Paragraph:
[0767] As at the AC&M processor, the FEV's situational awareness display uses color cues to indicate vehicles in a collision or zone incursion condition. As ADS and GPS messages are received and processed by the on board NAV Processor, graphics messages are formatted and sent to the local Graphics Processor (GP). These graphics messages are identical to those created at the AC&M Processor and include the vehicle id, layer id and map x,y,z position.

Detail Description Paragraph:
[0785] Map temporal differential corrections are a simple and effective means of reducing error sources in GPS operation for short periods of time when Selective Availability is not active. FIG. 31 depicts the map temporal correction elements.

Detail Description Paragraph:
[0786] Map temporal corrections utilize at least one precisely surveyed location in the local area. The surveyed location may be determined from a monument marker or may be determined using a highly accurate digital or paper map. A GPS receiver and (optionally) a processing computer are co-located at the known location with the GPS antenna carefully positioned at the survey point. The receiver/computer remains at the known location for a period of time and, when enough data has been collected, determines pseudo range correction and pseudo range rate factors. These correction factors may then be applied to the differential GPS receiver to determine a corrected position. These factors are used in subsequent position determinations until another map temporal correction is applied.

Detail Description Paragraph:
[0787] Map temporal corrections are the simplest form of closed loop differential correction. As the name implies, temporal corrections degrade with time as the receiver moves within the local area. SA significantly reduces the benefits of a temporal differential correction approach. When SA is not active, the short term (30 minute) accuracy of this technique is very good (a meter or two), since all error sources are reduced. One additional limiting factor is that the same satellites must be used during roving operations as those used at the surveyed location. This may be accomplished through software control to ensure a `selected` set of satellites are used for a given GPS session.

Detail Description Paragraph:
[0789] Real time differential correction techniques compensate for a number of error sources inherent to GPS. The idea is simple in concept and basically incorporates two or more GPS receivers, one acting as a stationary base station and the other(s) acting as roving receiver(s). The differential base station is "anchored" at a known point on the earth's surface. The base station receives the satellite signals, determines the errors in the signals and then calculates corrections to remove the errors. The corrections are then broadcast to the roving

receivers.

Detail Description Paragraph:
[0790] Real time differential processing provides accuracies of 10.0 meters or better (typically 1.0-5.0 meters for local differential corrections). The corrections broadcast by the base station are accurate over an area of about 1500 km or more. Typical positional degradation is approximately a few millimeters of position error per kilometer of base station and roving receiver separation. FIG. 32 shows the basic elements for real time differential GPS (DGPS) operations.

Detail Description Paragraph:
[0791] Through the implementation of local differential GPS techniques, SA errors are reduced significantly while the atmospheric errors are almost completely removed. Ephemeris and clock errors are virtually removed as well.

Detail Description Paragraph:
[0792] Differential GPS can introduce an additional error, if not employed properly. The age of the differential correction must be monitored at the GPS receiver. As the differential correction ages, the error in the propagated value increases as well. This is particularly true for `virulent` strains of SA where the errors introduced slew quickly over very short time intervals.

Detail Description Paragraph:
[0794] The precisely surveyed location of the GPS antenna is programmed into the reference station as part of its initial installation and set up procedures. Industry standard reference stations determine pseudo range and delta range based on carrier smoothed measurements for all satellites in view. Since the exact ECEF position of the antenna is known, corrections may be generated for the pseudo range and delta range measurements and precise time can be calculated.

Detail Description Paragraph:
[0796] As shown previously in FIG. 32, the DGPS correction messages are broadcast by the reference station and received by the roving receivers. The corrections are applied directly to the differential GPS receiver. The DGPS receiver calculates the pseudo range and the delta range measurements for each satellite in the usual manner. Prior to performing the navigation solution, the received pseudo range and delta range corrections are applied to the internal measurements. The receiver then calculates corrected position, velocity and time data. Typical DGPS position and velocity performance is presented in the table below.

Detail Description Paragraph:
[0797] Since differential GPS eliminates most GPS errors, it provides significant improvements in system reliability for life critical airport operations. Short term and long term drift of the satellite orbits, clocks and naturally occurring phenomenon are compensated for by differential GPS as are other potential GPS satellite failures. Differential GPS is mandatory in the airport environment from a reliability, accuracy and fault compensating perspective.

Detail Description Paragraph:
[0798] As with autonomous GPS receiver operation, multipath is a potential problem. The differential reference station cannot correct for multipath errors at the roving receiver(s). Antenna design and placement considerations, and receiver design characteristics remain the best solutions to date in the minimization of multipath effects.

Detail Description Paragraph:
[0799] DGPS provides the means to eliminate most GPS system errors. The remaining errors are related to receiver design and multipath. Not all GPS receivers and reference stations are created equal, some are distinctly better than others. The selection of the reference station and the roving receivers has a significant

effect on the overall system accuracy.

Detail Description Paragraph:
[0802] FIG. 33 has additional elements over the standard differential system configuration. A second GPS antenna is installed at a precisely surveyed antenna location and a stationary GPS receiver is co-located with the reference station. This receiver accepts differential correction inputs generated by the reference station. The stationary GPS receiver incorporates the pseudo range corrections in the normal manner and determines DGPS position and velocity. The corrected position and velocity are then compared to the stationary receivers known position and velocity (0,0,0). The ECEF delta position and velocity data are then used by the reference station processing to further refine the pseudo range and delta range corrections which are broadcast to the roving receivers. Processing software which minimizes the position and velocity errors is used. This technique requires that the roving receivers be identical to the stationary GPS receiver located at the reference station site. That is, the roving receivers must exhibit receiver errors similar to those on the stationary DGPS receiver.

Detail Description Paragraph:
[0803] The issues of integrity and fault monitoring are a major concerns for any technology considered for the life critical application of air transport and air traffic control. The integration of GPS with other technologies provides a higher degree of fault detection capability, a potentially improved GPS navigational performance, and the potential of limited navigation support should a catastrophic GPS failure occur aboard the vehicle.

Detail Description Paragraph:
[0804] The integration of GPS with an inertial system can be used to improve the dynamic performance of the navigation solution. Dynamic sensors may provide jerk, acceleration and velocity information to aid in the navigation solution. Sole means inertial navigation may be used in conjunction with GPS. The integration of GPS with inertial systems usually require 12 (or higher) state Kalman filter solutions techniques .

Detail Description Paragraph:
[0805] The concept of Receiver Autonomous Integrity Monitoring (RAIM) is accepted as a potential integrity monitoring system. The RAIM concept requires that the GPS receiver and/or navigation system include the required "smarts" to diagnose its own health using additional satellites, redundant hardware and specialized internal software processing. RAIM standards are currently being developed for industry approval.

Detail Description Paragraph:
[0806] When combined with other sensors such as WAAS, inertial, baro altimeter and internal RAIM processing, GPS will have superior accuracy, fault tolerance and fault detection capability.

Detail Description Paragraph:
[0821] 4. differential GPS for all navigation

Detail Description Paragraph:
[0831] 8. a differential GPS base station

Detail Description Paragraph:
[0842] Redundant Differential GPS are also required, since a single point failure can not be tolerated in airport navigation functions.

Detail Description Paragraph:
[0857] Multiple controller stations may be added to support larger airport systems. In this case a slightly different architecture is utilized. Common elements are

shared by multiple stations. In the 2 station architecture shown parallel differential GPS base stations, parallel lighting control interfaces, parallel Local Area Networks and parallel transceivers are utilized. Since a redundant capability is provided with multiple controller stations consisting of 2 of 3scenario increased availability is provided as shown in FIG. 30.

Detail Description Paragraph:
[0870] GPS Compatible Monumentation

Detail Description Paragraph:
[0871] Airport ALP generation or mapping activities may use any number of map coordinate systems based on a number of earth datums or ellipsoid references. Standardization of the mapping techniques and references are key in the development of any successful multi-use mapping program. In addition to the selection of a standard reference system, the interface to the local area surrounding the airport must be addressed. Accurate cross referenced monumentation points are necessary to allow for a smooth transition between the local coordinate system and the one used in the airport maps or in the navigation system. In the U.S., local State Plane Coordinate Systems (SPCS) form the baseline for most local mapping activities. As such, the ALPs for all U.S. airports should be monumented with reference points to provide for accurate coordinate conversion between World Geodetic Survey of 1984 (WGS 84) Latitude--Longitude, Earth Centered Earth Fixed (ECEF) X, Y, Z and local SPCSs or Universal Transverse Mercator (UTM). GPS and conventional survey techniques are recommended for such monumentation.

Detail Description Paragraph:
[0872] The surveyed accuracy of the multi-use airport map is recommended to be better than 0.5 meters for the horizontal and 0.1 meter for elevation. Of particular interest are the Airport Runway Touch Down Marker Reference Points (the precise coordinates of the center of a runway's touch down marker) and the Airport Runway Reference Points (the precise coordinates along the centerline path of the runway). In addition, the precise locations of all turn outs and turn ins should be identified in the airport map database.

Detail Description Paragraph:
[0873] Earth reference systems used in these locations should be ECEF X,Y,Z, North American Datum of 1983 (NAD 83) or WGS 84 latitude, longitude, MSL. These three models are compatible with GPS-based navigation. Should the positions not be in one of these coordinate reference systems, then local airport multi-coordinate reference monumentation should be used to support the required coordinate conversions.

Detail Description Paragraph:
[0880] NAD 83 data sheets contain information to update North American 1927 references. The data sheets contain new information which is relevant for precise surveys and users of GPS equipment. These include: precise latitude and longitude [DDD MM SS.sssss], latitude--longitude shift in seconds of degree from NAD 27 to NAD 83, elevation above the geoid with standard error, geoid height and standard error, state plane and Universal Transverse Mercator (UTM) coordinates. These fundamental corrections and ellipsoid constants are the basic parameters used in many coordinate conversions and navigational programs and form the basis of modem survey measurements. GRS 80 used by NAD 83 has the following fundamental parameters:

Detail Description Paragraph:
[0884] The North American Datum of 1983 (NAD 83) and World Geodetic Survey of 1984 (WGS 84) attempt to describe the surface of the earth from two different perspectives. NAD 83 describes the surface of North America using the Geodetic Reference System of 1980 (GRS 80) ellipsoid and over 1.7 million actual measurements. A least squares Helmert blocking analysis was performed by National

Geodetic Survey (NGS) on these measurements to determine the best fit solution to the actual measurements. NAD 83 uses monumented reference points across the country to precisely reference various coordinate systems such as the State Plane Coordinate Systems. WGS 84 incorporates positional references using GPS and local references. Position determination by GPS incorporates precise Keplerian orbital mechanics and radio positioning technology. Clearly, the two systems are describing the same thing, but the methods of determining a position are different.

Detail Description Paragraph:
[0886] Computations to determine the latitude and longitude from ECEF X,Y,Z coordinates highlight the small difference in the two reference systems. It has been shown that the maximum error between the two reference systems occurs at a latitude of 45 degrees. (Refer to North American Datum of 1983, Charles R. Schwartz) No error occurs between the two systems in the determination of longitude. The maximum error amounts to 0.000003 seconds of arc which amounts to a latitude shift of 0.0001 meters. For all practical purposes, the computational differences between the two systems are negligible. This is an important point for, if the two earth models differed in basic latitude and longitude computations, serious charting and navigational problems would occur and GPS navigation based on NAD 83 referenced maps would be seriously limited.

Detail Description Paragraph:
[0887] Both WGS 84 and NAD 83 have many common points used as local reference points. The differences between the two systems may reach several meters in rare locations, but on the average the systems should be identical. Generally, measurement errors and equipment inaccuracies introduce more error than the differences in the two systems.

Detail Description Paragraph:
[0888] For airport mapping and GPS navigation we can assume that errors due to the differences between the NAD 83 and WGS 84 ellipsoid models are negligible. This implies that either system can be used in calculating navigational entities and performing precise mapping with GPS navigation. The monumented New Hampshire points established on NAD 83 near the airport are well within the measurement accuracy of the GPS survey and navigation equipment. The documented offsets between NAD 83 and WGS 84 for New Hampshire are 0.0 meters in the Y direction and -0.5 meters in the X direction.

Detail Description Paragraph:
[0890] A digital map of Manchester (NH) Airport was created to support early test activities. The digital map was based on aerial photogrammetry and GPS ground control using postprocessing software. A Wild Heerbrugg aerial camera equipped with forward motion compensation was used to capture the photogrammetry. The 3-D digitalization was performed using a Zeiss stereoscopic digitizing table. During the digitalization process, numerous object oriented map layers were constructed to segregate various types of map information. The resulting 3-D digital map had a relative horizontal accuracy of better than 1.0 meter and a relative vertical accuracy of better than 0.1 meter across the airport.

Detail Description Paragraph:
[0898] The use of modern digital Computer Aided Design (CAD) techniques is required for the development of electronic map databases. The use of GPS-based, ground referenced photogrammetry with post processing 2 or 3-D digitalization provides a cost effective, highly accurate and automated method of constructing the 2 or 3-D ALP.

Detail Description Paragraph:
[0907] In order to integrate GPS navigational data with 2 or3-D maps, the potential map formats must be evaluated for compatibility and ease of use with the navigational output and coordinate reference system. The table below lists twelve

of the most likely combinations.

Detail Description Paragraph:
[0909] To illustrate the differences between GPS trajectories displayed in maps using different coordinate systems, the following plot examples are provided. FIG. 12 shows a plan view of latitude versus longitude. FIG. 14 shows the same trajectory in ECEF X and Y coordinates. FIG. 13 depicts the MSL Altitude versus Time while FIG. 15 shows the ECEF X values versus Time. Note the distortion between the latitude, longitude, MSL altitude and the ECEF X,Y, and Z coordinates. (The small rectangles on each plot represent waypoints along the trajectory path.)

Detail Description Paragraph:
[0919] At least three (3) ARPs, located within the airport confines in areas which are not likely to be disturbed, are recommended. Where possible, these points should be placed in the far corners of the airport to form a triangle. These points should be surveyed with GPS based survey equipment and monumented physically on the ground and within the digital map database.

Detail Description Paragraph:
[0923] Earth reference systems used for the various map projections should be the NAD 83 or WGS 84. Older, previously accepted datums which do not correlate with GPS navigation or surveys should be avoided.

Detail Description Paragraph:
[0925] GPS calibration areas should be located at all gates or areas where aircraft remain stationary. These areas should be identified in the airport digital map. The purpose of the calibration area is to allow the pilot to check the accuracy of the on board GPS equipment.

Detail Description Table CWU:
14 WORLD WIDE USE The coordinate reference system is recognized throughout the world. Scale does not change as a function of where you are on the earth. SIMPLE NAVIGATION The coordinate system lends itself MATHEMATICS to simple vector navigational mathematics. COMPATIBLE WITH The coordinate reference can COMPLEX 4-D CURVED support curved trajectory PATH 4-D NAVIGATION mathematics. FUNCTIONS COMPATIBLE WITH Is compatible with management MANAGEMENT SYSTEM operations at ATC and aboard A/Vs. COMPATIBLE WITH SPACE The coordinate system is compatible OPERATIONS with low earth orbit or space-based operations. NAD83 AND WGS84 REF. The reference system is compatible with NAD 83 and WGS 84 SINGLE ORIGIN The system has one single point origin. LINEAR SYSTEM The system is a linear coordinate system and does not change scale as a function of location. UNITS OF DISTANCE The coordinate system is based on units of distance rather than angle NO DISCONTINUTITIES The coordinate reference system is continuous world wide.

Detail Description Table CWU:
27 ERROR SOURCES CORRECTED OR REDUCED BY DGPS USER RANGE ERRORS (URE) 1 SIGMA MAGNITUDES WITHOUT DGPS WITH DGPS SATELLITE CLOCK & NAV. 2.7 0 EPHEMERIDES & PREDICTION 2.7 0 ATMOSPHERIC IONOSPHERIC 9.0 0 TROPOSPHERIC 2.0 .15* SELECTIVE AVAILABILITY 30.0# 0 TOTAL RSS 31.6 .15 *Tropospheric effects are a local phenomenon and are a function of the altitude difference from the base station to the roving receiver and the local elevation angle of the satellite. #To counteract the effects of SA, differential corrections must be generated, transmitted and utilized in the GPS receiver at a rate sufficient to compensate for the rate of change of SA.

Detail Description Table CWU:
28 COMPARISON OF TYPICAL GPS POSITION AND VELOCITY MEASUREMENTS USING COMMERCIAL NAVIGATION TYPE RECEIVERS (ACCURACIES ARE A FUNCTION OF CORRECTION AGE) THIS EXAMPLE USES CORRECTION AGE = 5 SECONDS WITHOUT DGPS WITH DGPS CODE RCVR CARRIER RCVR CODE RCVR CARRIER RCVR 2-D POSITION <100 M <40 M <10 M <2 M 3-D POSITION <176

M <80 M <18 M <4 M VELOCITY knots <10 KN <5 KN <.1 KN <.1 KN TIME* <300 ns <100 ns <100 ns <50 ns *The time accuracy is highly dependent upon the type of receiver. Specialized, precise time receivers provide accuracies in the 5 to 25 nanosecond range. Most navigational receivers do not provide this level of time accuracy since it is not required for general navigation.

Detail Description Table CWU:
35 COMPLIANCY MATRIX * * * MAPPING FORMAT: 1 2 3 4 5 6 7 8 9 10 11 12 EXISTING MAP DATA Y Y Y Y Y Y Y Y N N N N RECOGNIZABLE MAP Y Y Y Y Y Y Y Y N N N N CONV. SW EXISTS Y Y Y Y Y Y Y Y Y Y Y Y EASY 3D-2D CONV Y Y Y Y Y Y Y Y N N N N MULTI-USE FORMAT Y Y Y Y Y Y Y Y N N N N WORLD WIDE SYSTEM Y Y Y Y N N N N Y Y Y Y LINEAR SYSTEM N N N N Y Y Y Y Y Y Y Y GPS COMPATIBLE Y Y Y Y N N N N Y Y Y Y SEAMLESS SYSTEM N N N N N N N N Y Y Y Y NAV INPUT-OUTPUT: RECOGNIZABLE Y Y N N N Y Y N N Y Y N ACCEPTED STANDARD Y Y N N N Y Y N N Y Y N WORLD WIDE USE Y Y N Y N Y Y Y Y Y Y N GPS COMPATIBLE Y Y N Y N Y Y Y Y Y Y N CHARTS AVAILABLE Y Y N N Y Y Y N N Y Y Y COORD REFERENCE: RECOGNIZABLE REF. Y N N N Y Y N N N N Y Y WORLD WIDE USE Y Y Y Y N Y Y Y Y Y Y N SIMPLE NAV. MATH. N Y Y Y Y N Y Y Y Y N Y NAD83 & WGS84 REF Y Y Y Y Y Y Y Y Y Y Y Y SINGLE 3D ORIGIN N Y Y Y N N Y Y Y Y N N LINEAR SYSTEM N Y Y Y Y N Y Y Y Y N Y UNITS OF DISTANCE N Y Y Y Y N Y Y Y Y N Y * * * TOTAL YES COUNT: 15 18 13 15 12 14 17 14 13 16 13 11 MAPPING: CRITERIA DEFINITIONS COMPATIBILITY WITH Existing digital map data is available for the airport EXISTING MAP DATA and surrounding area. RECOGNIZABLE MAP A map which is instantly recognizable, one which resembles the surface on which we live. The map should not need to be differentially corrected from the reference geoid. CONVERSION SW EXISTS Commercially available software exists to convert from one 3-D map reference system to the other EASY 3D-2D CONVERSION Digital map presentations can be easily converted from 3-D to 2-D by setting the altitude to zero without any additional mathematical conversions in the raw map data or in the 3-D graphical interface. MULTI-USE FORMAT The map data is in a standard format which can satisfy multi-use needs such as Master Plans, construction needs, ATC and general navigation. WORLD WIDE SYSTEM References in the map are with respect to world wide datums and accepted world wide mapping units. LINEAR SYSTEM The axes and units of the map are linear and represent distance. GPS COMPATIBLE Mapping units and presentations are directly compatible with existing GPS receiver output formats and calculation references. SEAMLESS SYSTEM Maps do not have mathematical/physical discontinuity, the map format must be seamless on a world wide basis. For example UTM maps do not cover polar regions and map edges do not match on 6 degree boundaries when placed together. NAVIGATIONAL OUTPUT: RECOGNIZABLE The final navigational output should be instantly recognizable; i.e. if LAT, LON, MSL output is used, one can instantly visualize a location on the earth, while if ECEF outputs are given it is difficult to visually picture a point in space. ACCEPTED STANDARD Navigational format is an accepted standard; i.e. LAT, LON, MSL WORLD WIDE USE The navigational format is usable over the entire world. GPS COMPATIBLE Navigational format is compatible with existing GPS receiver outputs. CHARTS AVAILABLE Paper and digital charts are available. COORDINATE REFERENCE: WORLD WIDE USE The coordinate reference system is recognized throughout the world. SIMPLE NAVIGATION The coordinate system lends itself to simple linear MATHEMATICS navigational mathematics. NAD83 AND WGS84 REF. The reference system is compatible with North American Datum of 1983 and World Geodetic Survey of 1984. SINGLE ORIGIN The system has one and only one origin. LINEAR SYSTEM The system is a linear coordinate system. UNITS OF DISTANCE The coordinate system is based on units of distance rather than angle. * Suggested combinations 2, 7, 10

CLAIMS:

1. An airport navigation method for a plurality vehicles selected from the group comprising aircraft and surface vehicles, said method comprising a. installing a GPS reference antenna at a known physical location, said physical location being GPS referenced; b. preparing an airport map that is GPS referenced; said map containing at least one digital representation of features selected from the group

comprising runways, taxiways, gate areas, geographical features of the area surrounding the airport, topography surrounding the airport, approach paths, departure paths and identified obstructions; c. providing said map to a vehicular navigation computer system; d. receiving GPS signals at said GPS reference antenna; e. providing said received GPS signals to a Differential GPS base station; f. calculating with said Differential GPS base station differential corrections; g. providing said differential corrections to a radio transmitter; h. broadcasting using said radio transmitter, said differential corrections to said vehicle; i. receiving using a radio receiver located on said vehicle said broadcast differential corrections; j. receiving GNSS signals using a GNSS antenna located on said vehicle and providing said received GNSS signals to a differential GNSS receiver located on said vehicle; k. providing said received differential corrections to said differential GPS receiver; l. calculating using said differential GPS receiver at least one differentially corrected information element selected from the group comprising 3-dimensional position, 2-dimensional horizontal position, vertical position, 3-dimensional velocity, speed, heading, vertical rate and time; m. navigating said vehicle using said differentially corrected information using said vehicular navigation computer system that displays said location of said vehicle on said digital map.

2. An airport control and management method for a plurality vehicles selected from the group comprising aircraft and surface vehicles, said method comprising a. installing a GPS reference antenna at a known physical location, said physical location being GPS referenced; b. preparing an airport map that is GPS referenced; said map containing at least one digital representation of features selected from the group comprising runways, taxiways, gate areas, geographical features of the area surrounding the airport, topography surrounding the airport, approach paths, departure paths and identified obstructions; c. providing said map to an airport control and management computer system; d. receiving GPS signals at said GNSS reference antenna; e. providing said received GPS signals to a Differential GPS base station; f. calculating with said Differential GPS base station differential corrections; g. providing said differential corrections to a radio transmitter; h. broadcasting using said radio transmitter, said differential corrections to said vehicle; i. receiving using a radio receiver located on said vehicle said broadcast differential corrections; j. receiving GPS signals using a GPS antenna located on said vehicle and providing said received GPS signals to a differential GPS receiver located on said vehicle; k. providing said received differential corrections to said differential GPS receiver; l calculating using said differential GPS receiver at least one differentially corrected information element selected from the group comprising 3-dimensional position, 2-dimensional horizontal position, vertical position, 3-dimensional velocity, speed, heading, vertical rate and time; m. broadcasting differentially corrected position information indicative of said vehicle location using a radio transmitter located on said vehicle; n. receiving said broadcast position information at said control and management computer system; o. presenting said airport map on a display of said airport control and management computer system and p. displaying the location of said vehicle in said presented airport map using said received broadcast position information.

3. An airport navigation system, the system comprising: a. a GPS antenna used to receive broadcast signals from GPS satellites, said GPS antenna located at a known location, identified with 3-dimensional GPS compatible coordinates; b. a differential GPS base station that receives GPS signals from said GPS antenna; c. means within said differential GPS base station to calculate differential corrections consisting of psuedorange corrections; d. a radio transmitter connected to said differential GPS base station; e. means within said differential GPS base station to send psuedorange corrections to said radio transmitter; f. a radio receiver located on a vehicle selected from the group comprising aircraft and surface equipment; g. means on said vehicle to receive said psuedorange corrections using said radio receiver and means to provide said psuedorange corrections to an onboard differential GPS receiver; h. means to calculate a differentially corrected

position using said onboard differential GPS receiver and said received psuedorange corrections and i. means to navigate said vehicle using said differentially corrected GPS position.

Previous Doc Next Doc Go to Doc#

Results of Search in 1976 to present db for:

(SPEC/gps AND ACLM/"differential information"): 9 patents.

6873905	Communications type navigation device
6771214	GPS near-far resistant receiver
6381535	Interactive process for use as a navigational aid and device for its implementation
6282431	Time correcting method and portable remote telephone terminal in which time is corrected in accordance with such method
6236849	System and method of determining a mobile station's position using directable beams
6176130	Flight velocity vector measuring system in wide velocity region using truncated pyramid-shape probe
5563786	Autonomous running control system for vehicle and the method thereof
5528888	Autonomous mowing vehicle and apparatus for detecting boundary of mowed field
5132695	Radio navigation system

L18: Entry 1 of 5 File: PGPB Mar 17, 2005

DOCUMENT-IDENTIFIER: US 20050059410 A1
TITLE: System and method for providing differential location services

Abstract Paragraph:
A system and method are presented for providing a differential location to a terminal. The system includes a service provider that can receive a request for a differential location service from the terminal at least partially over a wireless network, where the request includes a geographic area defined independent of a specific format. A mapping processor can receive the geographic area from the service provider, and thereafter transform the geographic area of the request to thereby define the geographic area in a predetermined manner. The mapping processor can send the geographic area defined in the predetermined manner to the service provider. Upon receiving the geographic area defined in the predetermined manner, the service provider can determine whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

Application Filing Date:
20030917

Summary of Invention Paragraph:
[0004] A special type of location-based service, often referred to as a differential location service, provides functionality based on the distance of the mobile station between two or more locations. For example, when the mobile station, and thus the mobile subscriber, moves to a location exceeding a predefined distance from the location of a desired meeting location, various precautionary actions can be triggered, such as sending out "running late" messages to the attendants of a meeting at the meeting location.

Summary of Invention Paragraph:
[0005] Whereas current techniques are adequate for providing location services, and differential location services, such techniques have drawbacks. In this regard, conventional techniques for providing location services are typically bound to specified operators or systems as such techniques rely on dedicated network functionality, such as IN signaling or cell ID information in GSM. And with the increasing importance of service provisioning in a multidimensional heterogeneity, network- and system-bound techniques for providing location services do not typically adequately provide location services across networks, operators, vendors and/or even terminals.

Summary of Invention Paragraph:
[0006] More particularly, location information used in providing differential location services can exist in multiple formats, e.g., expressed as GPS, cell ID, place name, RFID tag, and the like. Due to the multiplicity of location information formats, conventional network-bound services typically do not suffice for providing differential location triggers. Various mapping services, such as MapQuest or MapPoint .NET, do provide transformation of certain location information, typically addresses or place names, into GPS-like coordinates (although MapQuest provides a map output rather than coordinates). Such mapping services also support differential location information, however, they do not support arbitrary location

information such as cell ID or RFids. Also, such mapping services do not provide triggering certain actions based on differential location triggers. And whereas other mapping techniques, such as those provided in cellular networks (e.g., GSM) also provide some form of mapping services, they only support cellular-specific location information, such as cell ID and the respective geographic data. They do not provide triggers, and further do not support other non-cellular location information.

Summary of Invention Paragraph:
[0007] In light of the foregoing background, embodiments of the present invention provide an improved system, method and computer program product for providing differential location services. According to embodiments of the present invention, a service provider is capable of providing the differential location services based upon the location of a terminal relative to a specified geographic area. Advantageously, the service provider may receive the location of the terminal and/or the specified geographic area, where one or both are defined in a manner independent of a specific format, which may be a format specified by the terminal and/or the service provider. More particularly, the location of the terminal and/or the specified geographic area can be defined in a manner independent from any specific access technology or location definition. In this regard, the service provider can receive the location of the terminal and/or the specified geographic area such that one or both can be transformed to thereby define one or both in a predetermined manner (e.g., geographic (X, Y, Z) coordinates).

Summary of Invention Paragraph:
[0008] According to one aspect of the present invention, a system is presented for providing differential location service to a terminal. The system includes a service provider and a mapping processor. The service provider is capable of receiving a request for a differential location service from the terminal at least partially over a wireless network. The request includes a geographic area defined independent of a specific format, and in this regard, the mapping processor is capable of receiving the geographic area from the service provider. Thereafter, the mapping processor can transform the geographic area of the request to thereby define the geographic area in a predetermined manner. The mapping processor can send the geographic area defined in the predetermined manner to the service provider. Upon receiving the geographic area defined in the predetermined manner, the service provider can determine whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

Summary of Invention Paragraph:
[0009] To provide the differential location service, the service provider can be capable of obtaining a current location of the terminal, such as from a location provider. More particularly, the service provider can obtain the current location of the terminal such that the mapping processor can thereafter transform the current location of the terminal to thereby define the current location in the predetermined manner. The service provider can then be capable of comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner, and thereafter determine whether to provide the requested differential location service based upon the comparison.

Summary of Invention Paragraph:
[0010] In addition to the geographic area, the request can include any one or more of a number of different pieces of information. For example, the request can further include a validity time to subscribe to a differential location service. In such instances, the service provider can be capable of determining if the subscription is valid based upon a current time and the validity time. The service provider can then provide the requested differential location service when the subscription is valid. As another example, the request can further include an

action. When the request includes an action, the service provider can be capable of providing the requested differential location service by executing the action based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

Summary of Invention Paragraph:
[0011] As yet another example, the request can further include a trigger condition. In such instances, the service provider can be capable of providing the requested differential location service if, based upon a comparison of the current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition. In a more particular example, the trigger condition can specify either "outside" or "inside." Then, when the trigger condition specifies "outside," the service provider can be capable of providing the requested differential location service if the current location of the terminal is outside the geographic area. On the other hand, when the trigger condition specifies "inside," the service provider can be capable of providing the requested differential location service if the current location of the terminal is inside the geographic area.

Summary of Invention Paragraph:
[0012] According to another aspect of the present invention, a method is presented for providing a differential location service to a terminal. Embodiments of the present invention therefore enable service providers to provide differential location services independent of a specified location information format, and without utilizing a pre-existing, specific location service infrastructure. Advantageously, and in accordance with embodiments of the present invention, the service provider bears the burden of supporting a variety of different location formats, thus reducing the resources required of the terminal to receive differential location services in accordance with conventional techniques. Hence, the terminal can receive differential location services by merely providing a geographic area, and possibly terminal location, in any of a number of different formats without bothering to transform the location geographic area or terminal location, and without comparing the terminal location with the geographic area. Therefore, the systems and methods of embodiments of the present invention solve the problems identified by prior techniques and provide additional advantages.

Brief Description of Drawings Paragraph:
[0016] FIG. 3 is a control flow diagram illustrating various steps in a method of providing differential location services according to one embodiment of the present invention; and

Brief Description of Drawings Paragraph:
[0017] FIG. 4 is a flow chart illustrating various steps in a method of providing differential location services according to one embodiment of the present invention.

Detail Description Paragraph:
[0021] The MSC 16 can be coupled to a data network, such as a local area network (LAN), a metropolitan area network (MAN), and/or a wide area network (WAN). The MSC can be coupled to the data network directly, or if the system includes a GTW 20 (as shown), the MSC can be coupled to the network via the GTW. In one typical embodiment, for example, the MSC is coupled to the GTW, and the GTW is coupled to a WAN, such as the Internet 22. In turn, devices such as processing elements (e.g., personal computers, server computers or the like) can be coupled to the terminal 10 via the Internet. For example, the processing elements can include one or more processing elements associated with a service provider 24, as well as one or more processing elements associated with one or more mapping processors 26, and/or one or more location providers 28, one of each being illustrated in FIG. 1.

Detail Description Paragraph:

[0022] As explained below, the service provider 24 is capable of providing one or more differential location services to one or more terminals 10 based upon the current locations of the terminals relative to one or more specified geographic areas. In turn, then, the mapping processor 26 is capable of transforming the current locations and/or the specified geographic areas to define the current locations and/or specified geographic areas in a predetermined manner, such as a set of geographic (X, Y, Z) coordinates. Each mapping processor can be capable of receiving, and thereafter transforming one or more current locations and/or specified geographic areas defined in one or more different manners. As shown and described, the service provider, mapping processor and the location provider 28 are distributed from one another, such as across the Internet 22. It should be understood, however, that any one or more of the service provider, mapping processor and location provider can be logically co-located with any one or more of the service provider, mapping processor and location provider.

Detail Description Paragraph:
[0023] In addition to the service provider 24, mapping processor 26 and/or the location provider 28, the network may be coupled to one or more wireless access points (APs) 25. In turn, the APs may be wirelessly coupled to one or more terminals 10. As will be appreciated, by directly or indirectly connecting the terminals and the other devices (e.g., origin server) to the Internet, the terminals can communicate with the other devices and with one another, such as according to the Hypertext Transfer Protocol (HTTP), to thereby carry out various functions of the terminal.

Detail Description Paragraph:
[0024] The service provider 24 can comprise a logical functional entity capable of receiving information regarding the location of one or more terminals 10, and thereafter providing one or more differential location services to the terminals based upon the locations of the respective terminals. The service provider can comprise an entity that is external to the wireless communication network, as shown in FIG. 1 (coupled to the wireless communication network via the Internet 22). Alternatively, the service provider can comprise an internal client, i.e., reside in any entity or node (including the terminal) within the wireless communication network.

Detail Description Paragraph:
[0025] Information regarding the location of the terminals 10 can be used by the service provider 24 to provide any of a number of different differential location services for any of a number of different purposes. For example, the service provider may transmit location-related information to the terminal 10 that is pertinent to a location within a particular geographic area, such as on weather, traffic, hotels, restaurants, or the like. Also, for example, the service provider may transmit messages to the terminal and/or one or more specified recipients, when the terminal is located in a predefined relation with respect to a geographic area. In addition, for example, the service provider may record anonymous location information (i.e., without any mobile station identifier), such as for traffic engineering and statistical purposes. Further, the service provider may enhance or support any of a number of supplementary services, such as an Intelligent Network (IN) service, bearer service and/or tele-service subscribed to by the terminal user.

Detail Description Paragraph:
[0026] There are also several other possible commercial and non-commercial differential location services that may be provided by the service provider 24 based upon the location of the terminal 10. Such possible applications include, for example, different local advertisement and information distribution schemes (e.g. transmission of information directed to those mobile users only who are currently within a certain geographic area), geographic area-related WWW-pages (such as time tables, local restaurant, shop or hotel guides, maps, local advertisements, etc.)

for the users of mobile data processing devices, and tracking of terminal users by anyone who wishes to receive this information. An application requiring real-time location regarding the movement of a terminal is a terminal movement prediction feature that the wireless communication network may utilize, for example, in dynamic network resource allocation. There are still various other possible differential location services capable of being provided by the service provider 24.

Detail Description Paragraph:
[0027] As indicated above, and explained below, to provide the location of the terminal 10 to the service provider 24, the service provider can be coupled to a location provider 28. In this regard, the location provider can be arranged to receive a request for location information, such as from the service provider. In such instances, the request for location information can include the identity of the terminal such as an international mobile subscriber identifier (IMSI), or a temporary identifier such as a temporary international mobile subscriber identifier (TIMSI). The location provider may respond to a location request from a service provider with location information for a target terminal 10 specified by the service provider. The location provider may therefore provide the service provider, on request or periodically, the current or most recent location (if available) of the target terminal or, if the location determination fails, an error indication and optionally the reason for the failure. For more information on one type of location provider, often referred to as a location server, see European telecommunications Standards Institute (ETSI) technical specification entitled: Location Services (3GPP TS23.171 and GSM 03.71), the contents of which are hereby incorporated by reference in its entirety.

Detail Description Paragraph:
[0028] The location provider 28 can be implemented in the core network and be arranged to determine the location of the terminal 10 in any of a number of different manners. For example, the location provider can capable of determining the location of the terminal based upon location information from the wireless communication network via the MSC 16 and/or a serving general packet radio service support node (SGSN) (not shown). Additionally or alternatively, for example, the location provider can determine the location of the terminal in accordance with any of a number of other techniques including, for example, triangulation, Global Positioning System (GPS), Assisted GPS (A-GPS), Time of Arrival (TOA), Observed Time Difference of Arrival (OTDOA) or the like, as such are well known to those skilled in the art.

Detail Description Paragraph:
[0030] Although shown and described herein as being coupled to the Internet 22, it should be appreciated that the location provider 28 may be logically located anywhere in the data network and/or wireless communications network. Also, the location provider may be distributed between several elements of the network, or may be implemented in a single element. Further, the location provider may also be an external node to the wireless communications network. According to one embodiment, for example, the terminal 10 or user equipment includes the location provider (e.g., GPS sensor 36--see FIG. 2), and thus provides the location provider functionality. In such instances, the terminal is capable of generating and transporting location information thereof to the service provider 24.

Detail Description Paragraph:
[0033] It is understood that the controller 34 includes the circuitry required for implementing the audio and logic functions of the mobile station. For example, the controller may be comprised of a digital signal processor device, a microprocessor device, and various analog to digital converters, digital to analog converters, and other support circuits. The control and signal processing functions of the mobile station are allocated between these devices according to their respective capabilities. Further, the controller may include the functionally to operate one

or more software programs, which may be stored in memory (described below). For example, the controller may be capable of operating a connectivity program, such as a conventional Web browser. The connectivity program may then allow the mobile station to transmit and receive Web content, such as according to HTTP, for example. Also, for example, the controller may be capable of operating a location services client that allows the mobile station to request, and thereafter, receive services based upon the location of the mobile station, as described in more detail below.

Detail Description Paragraph:
[0034] The mobile station also comprises a user interface 38 that may include a conventional earphone or speaker, a ringer, a microphone, a display, and a user input interface, all of which are coupled to the controller 34. The user input interface, which allows the mobile station to receive data, can comprise any of a number of devices allowing the mobile station to receive data, such as a keypad, a touch display (not shown) or other input device. In embodiments including a keypad, the keypad includes the conventional numeric (0-9) and related keys (#, *), and other keys used for operating the mobile station. In addition, the mobile station can include a positioning sensor, such as a global positioning system (GPS) sensor 36. In this regard, the GPS sensor is capable of determining a location of the mobile station, such as longitudinal and latitudinal directions of the mobile station.

Detail Description Paragraph:
[0037] As indicated in the background section, conventional techniques for providing location services are typically bound to specified operators or systems as such techniques rely on dedicated network functionality. And as such, such conventional techniques typically cannot adequately provide location services across networks, operators, vendors and/or even terminals. In order to address the shortcomings of these conventional approaches, reference is now made to FIG. 3, which illustrates a control flow diagram according to exemplar methods of providing location information in the context of delivering location-based services. Advantageously, according to embodiments of the present invention, a service provider can be capable of providing location services, such as differential location services, independent of a specified location information format, and without utilizing a pre-existing, specified location service infrastructure.

Detail Description Paragraph:
[0038] According to the embodiment of the present invention shown in FIG. 3, a method of providing a differential location service begins with the terminal 10 requesting a differential location service from a service provider 24. To request the differential location service according to this embodiment, the terminal can send a request message 50 to the service provider. The request message can include one or more requests for one or more differential location services. Also, the request message can be formatted in any of a number of different manners, such as in accordance with ICMP (Internet Control Message Protocol), UDP (User Datagram Protocol) or SOAP (Simple Object Access Protocol).

Detail Description Paragraph:
[0039] The request message 50 can include any of a number of different pieces of information, but in one embodiment, the request message includes an action, a trigger, a geographic area and a validity time. The information in the request message can be formatted in any of a number of different manners, such as in accordance with Resource Description Framework (RDF) or XML (Extensible Markup Language). In the request message, the action defines the service provided by the service provider, where the service can be expressed as an action to be executed by the service provider. The action can comprise any of a number of different actions. For example, as explained below, the action can comprise sending a message to the terminal and/or one or more specified receivers.

Detail Description Paragraph:
[0041] The geographic area specified in the request message 50 typically defines a geographic area that the service provider 24 can compare with the location of the terminal 10, such as to determine whether the location of the terminal satisfies the specified trigger condition. The geographic area can be defined in any of a number of different manners. For example, the geographic area can be defined as a location and an area relative to the location. In this regard, the location can be defined in any of a number of different manners, such as in any of the different manners of defining the location of the terminal 10 described above (logical area, geographic coordinates, cell ID, RFID, etc.). Like the location, the area relative to the location can be defined in any of a number of different manners capable of defining a geographic area. For example, the area can be defined as a radius from the location (e.g., five mile radius), and/or a distance from the location (e.g., .DELTA.X, .DELTA.Y and/or .DELTA.Z; .DELTA.-longitude and/or .DELTA.-latitude, etc.).

Detail Description Paragraph:
[0047] The service provider 24 can initiate transformation of the geographic area in any of a number of different manners. According to one advantageous embodiment, for example, the service provider initiates transformation by communicating with a mapping processor 26. More particularly, the service provider can send a transformation request 52 to the mapping processor, where the transformation request includes the geographic area as defined in the request message 50. The service provider can send the transformation request to any of a number of different mapping processors. In one embodiment, however, the service provider is capable of selecting a mapping processor based upon the manner the request message defines the geographic area, and thereafter sending the transformation request to the respective mapping processor.

Detail Description Paragraph:
[0048] After receiving the transformation request 52, the mapping processor 26 can transform the geographic area into (X, Y, Z) coordinates. The mapping processor can then return the transformed geographic area to the service provider 24, such as in a response message 54. As will be appreciated, like the request message, the transformation request and response message can be formatted in any of a number of different manners, such as in accordance with ICMP, UDP or SOAP. Also, the information in the transformation request and response message can be formatted in any of a number of different manners, such as in accordance with RDF or XML.

Detail Description Paragraph:
[0049] After receiving the geographic area defined as a set of geographic (X, Y, Z) coordinates (whether from the terminal 10 in the request message 50 or from the mapping processor 26 in the response message 54), the service provider 24 can enter the subscription. Additionally, the service provider can store the subscription information provided in the request message, including the geographic area defined as a set of geographic (X, Y, Z) coordinates. After entering the subscription, then, the service provider can send an accept message 56 to the terminal 10 notifying the terminal that the service provider has accepted the entered subscription, where the accept response can, but need not, include a subscription identifier associated with the respective subscription.

Detail Description Paragraph:
[0050] Advantageously, and in accordance with embodiments of the present invention, after entering the subscription, the service provider 24 can compare the location of the terminal 10 with the specified geographic area in accordance with the specified validity time. By comparing the location of the terminal with the specified area, the service provider can determine when to provide the respective differential location service to the terminal. As will be appreciated, before comparing the location of the terminal with the geographic area, the service provider can receive the location of the terminal, such as from the terminal itself

and/or from the location provider 28. Then, based upon the comparison, the service provider can execute the specified action if the location of the terminal satisfies the specified trigger.

Detail Description Paragraph:
[0052] As shown in block 82, if the service provider 24 determines that the subscription is valid for the current time, the service provider can obtain the location of the terminal 10. The service provider can obtain the location of the terminal in any of a number of different manners, such as from the terminal itself or from the location provider 28. For example, the terminal can be responsible for determining its current location, and sending the current location to the service provider. In such instances, the terminal can determine its current location in any of a number of different manners. For example, the terminal can be capable of determining its current location based upon information obtained by the access technology of the terminal, such as the current cell ID. Additionally, or alternatively, the terminal can determine its current location from sources local to, or distributed from, the terminal. For example, the terminal can determine its current location from a GPS sensor, such as GPS sensor 36 (see FIG. 2). Additionally or alternatively, for example, the terminal can determine its current location from one or more RF identifiers (described above) or the like.

Detail Description Paragraph:
[0053] In addition to, or in lieu of, the terminal 10 determining its current location and sending its current location to the service provider 24, the location provider 28 can be responsible for determining the current location. In this regard, the location provider can determine the location of the terminal, such as in accordance with any of the number of manners described above. And whereas the location provider can determine the location of the terminal without interaction with the terminal, in one advantageous embodiment, the location provider determines the location of the terminal based upon an authorization of the terminal. For example, the location provider can determine the location of the terminal in accordance with an authorization, which the service provider can receive from the terminal and thereafter pass to the location provider as an authorization token.

Detail Description Paragraph:
[0054] As shown in FIG. 3, irrespective of how the terminal 10 or location provider 28 determines the current location of the terminal, the terminal and/or the location provider can send a location message 60 to the service provider 24, where the location message includes the current location of the terminal, and may also identify how the location is defined. The terminal or location provider can initiate sending the location message to the service provider, such as by sending a location message with a given periodicity or based upon changes in the location of the terminal. Additionally, or alternatively, the service provider can initiate reception of the location message, such as by sending a location request to the terminal or location provider when the service provider determines the subscription is valid.

Detail Description Paragraph:
[0055] Like the location specified by the geographic area in the request message 50, the current location of the terminal 10 can be defined by the location message 60 in any of a number of different manners, including any one of the manners described above for specifying the geographic area. In this regard, in instances in which the location message defines the current location of the terminal in a manner other than by a set of geographic (X, Y, Z) coordinates, the service provider 24 can initiate a transformation of the current location. The service provider can initiate transformation of the current location information in any of a number of different manners, but in one advantageous embodiment, the service provider sends a transformation request 62 to the mapping processor 26.

Detail Description Paragraph:

[0056] As with transformation request 52, the service provider can send transformation request 62 to any of a number of different mapping processors. In one embodiment, for example, the service provider selects a mapping processor based upon the manner the location message 60 defines the geographic area, and thereafter sends the transformation request to the respective mapping processor. As with transformation request 52, once the mapping processor receives transformation request 62, the mapping processor can transform the location of the terminal into a set of geographic (X, Y, Z) coordinates. The mapping processor can then return the transformed terminal location to the service provider, such as in a response message 64 that may comprise a message similar to response message 54.

Detail Description Paragraph:
[0057] Again referring to FIG. 4, after obtaining the location of the terminal 10, the service provider 24 can compare the location of the terminal with the geographic area to check if the location of the terminal satisfies the trigger condition specified in the subscription information, as shown in block 92. For example, if the trigger specifies the location of the terminal "outside" the specified geographic area, the service provider can compare the location of the terminal with the geographic area to determine whether the terminal is located outside the geographic area.

Detail Description Paragraph:
[0061] Upon receipt of the request message from the terminal 10, the service provider 24 can enter a subscription including the subscription information in the request message. Before entering the subscription, however, the service provider may communicate with the mapping processor 26 to transform the appointment location, and possibly the "vicinity," into a set of geographic (X, Y, Z) coordinates. After entering the subscription, the service provider can repeatedly check the validity of the subscription based upon the current time and the validity time (i.e., "reminder time"). Then, when the service provider determines that the subscription is valid (i.e., current time matches the "reminder time"), the service provider can obtain the location of the terminal. Upon obtaining the location of the terminal, as explained above, the service provider can again communicate with the mapping processor to transform the location of the terminal into geographic (X, Y, Z) coordinates.

Detail Description Paragraph:
[0062] After obtaining the location of the terminal 10 defined as a set of geographic (X, Y, Z) coordinates (whether from the terminal or location provider 28, or from the mapping processor 26), the service provider can compare the location of the terminal with the geographic area (defined by the appointment location and "vicinity") to check if the terminal is located "outside" the "vicinity" of the appointment location. Then, if the terminal is located "outside" the "vicinity," the trigger condition is satisfied, and the service provider can send the "running late" message to the appointment participants. After sending the "running late" message, or if the terminal is not located "outside" the "vicinity" (i.e., the terminal is located inside the "vicinity" of the appointment location), the service provider can again check the validity time. But because the validity time defined a single time, neither the current time nor any future time will match the validity time. As such, the service provider can cease to operate in accordance with the subscription.

Detail Description Paragraph:
[0063] As shown and described above, the location of the terminal and the geographic area can be defined in any of a number of different manners. As will be appreciated, according to advantageous embodiments of the present invention, the location of the terminal and the geographic area can be provided to the service provider 24 independent of a specific definition. As also shown and described above, the mapping processor 26 is capable of transforming the location of the terminal and/or the geographic area into sets of geographic (X, Y, Z) coordinates.

It should be understood, however, that the mapping processor need not transform the location of the terminal and/or the geographic area into geographic (X, Y, Z) coordinates. In this regard, the mapping processor can be capable of transforming the location of the terminal and/or the geographic area into any definition of the same that permits the service provider to compare the location of the terminal with the geographic area. For example, the mapping processor can transform the location information into latitude and longitude coordinates.

Detail Description Paragraph:
[0064] Embodiments of the present invention therefore enable service providers to provide differential location services independent of a specified location information format, and without utilizing a pre-existing, specified location service infrastructure. Also, by including the service provider functionality in a service provider distributed from the terminal, the terminal need not discover or search for appropriate transformation services to determine the differential location from the desired place. In this regard, in accordance with embodiments of the present invention, the burden of supporting a variety of different location formats is placed on the service provider. Hence, the terminal can receive differential location services by merely providing a geographic area, and possibly terminal location, in any of a number of different formats without bothering to transform the location geographic area or terminal location, and without comparing the terminal location with the geographic area.

Detail Description Paragraph:
[0065] According to various embodiments of the present invention, the system, terminal 10, service provider 24, mapping processor 26 and/or location provider 28 of embodiments of the present invention generally operate under control of a computer program product. The computer program product for performing the methods of embodiments of the present invention includes a computer-readable storage medium, such as the non-volatile storage medium, and computer-readable program code portions, such as a series of computer instructions, embodied in the computer-readable storage medium.

CLAIMS:

1. A method of providing a differential location service to a terminal, the method comprising: sending a request for a differential location service, the request including a geographic area defined independent of a specific format, wherein the request is sent at least partially over a wireless network; receiving the request, and thereafter transforming the geographic area of the request to thereby define the geographic area in a predetermined manner; and determining whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

2. A method according to claim 1, wherein determining whether to provide the requested differential location service comprises: obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and determining whether to provide the requested differential location service based upon the comparison.

3. A method according to claim 1, wherein sending a request comprises sending a request further including a validity time to subscribe to a differential location service, and wherein determining whether to provide the requested differential location service comprises: determining if the subscription is valid based upon a current time and the validity time; and providing the requested differential location service when the subscription is valid.

4. A method according to claim 1, wherein sending a request comprises sending a request further including a trigger condition, and wherein determining whether to provide the requested differential location service comprises providing the requested differential location service if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

5. A method according to claim 4, wherein sending a request comprises sending a request including a trigger condition specifying one of "outside" and "inside," wherein determining whether to provide the requested differential location service comprises providing the requested differential location service if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and providing the requested differential location service if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

6. A method according to claim 1, wherein sending a request comprises sending a request further including an action, and wherein determining whether to provide the requested differential location service comprises determining whether to execute the action based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

7. A method according to claim 6, wherein sending a request comprises sending a request further including a validity time and a trigger condition, and wherein determining whether to provide the requested differential location service comprises: determining if the subscription is valid based upon a current time and the validity time; and if the subscription is valid, obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition.

8. A system for providing a differential location service to a terminal, the system comprising: a service provider capable of receiving a request for a differential location service from the terminal at least partially over a wireless network, the request including a geographic area defined independent of a specific format; and a mapping processor capable of receiving the geographic area from the service provider, wherein the mapping processor is capable of transforming the geographic area of the request to thereby define the geographic area in a predetermined manner, and thereafter sending the geographic area defined in the predetermined manner to the service provider, wherein the service provider is also capable of determining whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

9. A system according to claim 8, wherein the service provider is capable of obtaining a current location of the terminal such that the mapping processor can thereafter transform the current location of the terminal to thereby define the current location in the predetermined manner, wherein the service provider is then capable of comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner, and thereafter determining whether to provide the requested differential location service based upon the comparison.

10. A system according to claim 8, wherein the request further includes a validity time to subscribe to a differential location service, and wherein the service provider is capable of determining if the subscription is valid based upon a current time and the validity time, and capable of providing the requested

differential location service when the subscription is valid.

11. A system according to claim 8, wherein the request further includes a trigger condition, and wherein the service provider is capable of providing the requested differential location service if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

12. A system according to claim 11, wherein the trigger condition specifies one of "outside" and "inside," wherein the service provider is capable of providing the requested differential location service if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and capable of providing the requested differential location service if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

13. A system according to claim 8, wherein the request further includes an action, and wherein the service provider is capable of determining whether to provide the requested differential location service by determining whether to execute the action based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

14. A system according to claim 13, wherein the request further includes a validity time and a trigger condition, wherein the service provider is capable of determining if the subscription is valid based upon a current time and the validity time, and if the subscription is valid, the service provider is capable of obtaining a current location of the terminal such that the mapping processor can thereafter transform the current location of the terminal to thereby define the current location in the predetermined manner, wherein the service provider is then capable of comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner, and thereafter executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition to thereby provide the requested differential location service.

15. A system for providing a differential location service, the system comprising: a terminal capable of sending a request for a differential location service, the request including a geographic area defined independent of a specific format, wherein the terminal is capable of sending the request at least partially over a wireless network; a service provider capable of receiving the request such that the geographic area can be transformed to thereby define the geographic area in a predetermined manner; and a location provider capable of providing a current location of the terminal to the service provider such that the service provider is capable of determining whether to provide the requested differential location service based upon a comparison of the current location of the terminal and the geographic area defined in the predetermined manner.

16. A system according to claim 15, wherein the service provider is capable of receiving the current location of the terminal from the location provider such that the current location can be transformed to thereby define the current location in the predetermined manner, wherein the service provider is then capable of comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner, and thereafter determining whether to provide the requested differential location service based upon the comparison.

17. A system according to claim 15, wherein the request further includes a validity time to subscribe to a differential location service, and wherein the service provider is capable of determining if the subscription is valid based upon a current time and the validity time, and capable of providing the requested

differential location service when the subscription is valid.

18. A system according to claim 15, wherein the request further includes a trigger condition, and wherein the service provider is capable of providing the requested differential location service if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

19. A system according to claim 18, wherein the trigger condition specifies one of "outside" and "inside," wherein the service provider is capable of providing the requested differential location service if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and capable of providing the requested differential location service if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

20. A system according to claim 15, wherein the request further includes an action, and wherein the service provider is capable of determining whether to provide the requested differential location service by determining whether to execute the action based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

21. A system according to claim 20, wherein the request further includes a validity time and a trigger condition, wherein the service provider is capable of determining if the subscription is valid based upon a current time and the validity time, and if the subscription is valid, the service provider is capable of receiving the current location of the terminal from the location provider such that the current location can be transformed to thereby define the current location in the predetermined manner, wherein the service provider is then capable of comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner, and thereafter executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition to thereby provide the requested differential location service.

22. A computer program product for providing a differential location service to a terminal, the computer program product comprising a computer-readable storage medium having computer-readable program code portions stored therein, the computer-readable program code portions comprising: a first executable portion for sending a request for a differential location service, the request including a geographic area defined independent of a specific format, wherein the request is sent at least partially over a wireless network; a second executable portion for receiving the request; a third executable portion for transforming the geographic area of the request to thereby define the geographic area in a predetermined manner; and a fourth executable portion for determining whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

23. A computer program product according to claim 22, wherein the fourth executable portion is adapted to determine whether to provide the requested differential location service by: obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and determining whether to provide the requested differential location service based upon the comparison.

24. A computer program product according to claim 22, wherein the first executable portion is adapted to send a request further including a validity time to subscribe to a differential location service, and wherein the fourth executable portion is

adapted to determine whether to provide the requested differential location service by determining if the subscription is valid based upon a current time and the validity time, and thereafter providing the requested differential location service when the subscription is valid.

25. A computer program product according to claim 22, wherein the first executable portion is adapted to send a request further including a trigger condition, and wherein the fourth executable portion is adapted to determine whether to provide the requested differential location service by providing the requested differential location service if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

26. A computer program product according to claim 25, wherein the first executable portion is adapted to send a request including a trigger condition specifying one of "outside" and "inside," wherein the fourth executable portion is adapted to provide the requested differential location service if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and provide the requested differential location service if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

28. A computer program product according to claim 27, wherein the first executable portion is adapted to send a request further including a validity time and a trigger condition, and wherein the fourth executable portion is adapted to determine whether to provide the requested differential location service by: determining if the subscription is valid based upon a current time and the validity time; and if the subscription is valid, obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition.

29. A computer program product for providing a differential location service to a terminal, the computer program product comprising a computer-readable storage medium having computer-readable program code portions stored therein, the computer-readable program code portions comprising: a first executable portion for receiving a request for a differential location service, the request including a geographic area defined independent of a specific format, wherein the request is received at least partially over a wireless network; a second executable portion for initiating transformation the geographic area of the request to thereby define the geographic area in a predetermined manner; and a third executable portion for determining whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

30. A computer program product according to claim 29, wherein the third executable portion is adapted to determine whether to provide the requested differential location service by: obtaining a current location of the terminal, and thereafter initiating transformation the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and determining whether to provide the requested differential location service based upon the comparison.

31. A computer program product according to claim 29, wherein the first executable portion is adapted to receive a request further including a validity time to subscribe to a differential location service, and wherein the third executable

portion is adapted to determine whether to provide the requested differential location service by determining if the subscription is valid based upon a current time and the validity time, and thereafter providing the requested differential location service when the subscription is valid.

32. A computer program product according to claim 29, wherein the first executable portion is adapted to receive a request further including a trigger condition, and wherein the third executable portion is adapted to determine whether to provide the requested differential location service by providing the requested differential location service if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

33. A computer program product according to claim 32, wherein the first executable portion is adapted to receive a request including a trigger condition specifying one of "outside" and "inside," wherein the third executable portion is adapted to provide the requested differential location service if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and provide the requested differential location service if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

35. A computer program product according to claim 34, wherein the first executable portion is adapted to receive a request further including a validity time and a trigger condition, and wherein the third executable portion is adapted to determine whether to provide the requested differential location service by: determining if the subscription is valid based upon a current time and the validity time; and if the subscription is valid, obtaining a current location of the terminal, and thereafter initiating transformation of the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition.

36. A computer program product for providing a differential location service to a terminal, the computer program product comprising a computer-readable storage medium having computer-readable program code portions stored therein, the computer-readable program code portions comprising: a first executable portion for sending a request for a differential location service, the request including a geographic area defined independent of a specific format, wherein the request is sent at least partially over a wireless network such that, upon receipt of the request, the geographic area of the request can be transformed to thereby define the geographic area in a predetermined manner, and wherein the request is sent such that it can be determined whether to provide the requested differential location service based upon a comparison of a current location of the terminal and the geographic area defined in the predetermined manner.

37. A computer program product according to claim 36, wherein the first executable portion is adapted to send the request such that it can be determined whether to provide the requested differential location service by: obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and determining whether to provide the requested differential location service based upon the comparison.

38. A computer program product according to claim 36, wherein the first executable portion is adapted to send a request further including a validity time to subscribe

to a differential location service such that it can be determined whether to provide the requested differential location service by determining if the subscription is valid based upon a current time and the validity time to thereby provide the requested differential location service when the subscription is valid.

39. A computer program product according to claim 36, wherein the first executable portion is adapted to send a request further including a trigger condition such that the requested differential location service can be provided if, based upon a comparison of a current location of the terminal and the geographic area, the current location of the terminal satisfies the trigger condition.

40. A computer program product according to claim 39, wherein the first executable portion is adapted to send a request including a trigger condition specifying one of "outside" and "inside" such that the requested differential location service can be provided if the current location of the terminal is outside the geographic area when the trigger condition specifies "outside," and if the current location of the terminal is inside the geographic area when the trigger condition specifies "inside."

42. A computer program product according to claim 41, wherein the first executable portion is adapted to send a request further including a validity time and a trigger condition such that it can be determined whether to provide the requested differential location service by: determining if the subscription is valid based upon a current time and the validity time; and if the subscription is valid, obtaining a current location of the terminal, and thereafter transforming the current location of the terminal to thereby define the current location in the predetermined manner; comparing the current location of the terminal defined in the predetermined manner with the geographic area defined in the predetermined manner; and executing the action if, based upon the comparison, the current location of the terminal satisfies the trigger condition.

Previous Doc Next Doc Go to Doc#

First Hit Previous Doc Next Doc Go to Doc#

End of Result Set

Generate Collection Print

L8: Entry 1 of 1 File: PGPB Oct 7, 2004

PGPUB-DOCUMENT-NUMBER: 20040198389
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040198389 A1

TITLE: Method and system for delivery of location specific information

PUBLICATION-DATE: October 7, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Alcock, William Guy	Indialantic	FL	US	
Vitardebo, Kenneth Martin	Satellite Beach	FL	US	
McWilliams, Timothy Francis	Melbourne	FL	US	

APPL-NO: 10/ 348693 [PALM]
DATE FILED: January 22, 2003

INT-CL: [07] H04 Q 7/20, H04 M 3/42

US-CL-PUBLISHED: 455/456.1; 455/457, 455/414.1
US-CL-CURRENT: 455/456.1; 455/414.1, 455/457

REPRESENTATIVE-FIGURES: 3

ABSTRACT:

A method and system for delivering location specific information to a receiver without the receiver having to transmit its location. The method includes self-determining a location of a receiver and receiving a signal comprising information pertaining to a wide geographical area. The method further includes selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information that only applies to a self-determined geographic location of the receiver. The method may also include broadcasting a signal to a wide geographic area, wherein information in the signal is tagged to specific geographic locations. The system includes at least one receiver comprising a locator for self-determination of geographic location and a discriminator for extracting appropriate location specific information. The system may also include a base station for broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

Previous Doc Next Doc Go to Doc#

First Hit Previous Doc Next Doc Go to Doc#
End of Result Set

Generate Collection Print

L8: Entry 1 of 1 File: PGPB Oct 7, 2004

DOCUMENT-IDENTIFIER: US 20040198389 A1
TITLE: Method and system for delivery of location specific information

Abstract Paragraph:
A method and system for delivering location specific information to a receiver without the receiver having to transmit its location. The method includes self-determining a location of a receiver and receiving a signal comprising information pertaining to a wide geographical area. The method further includes selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information that only applies to a self-determined geographic location of the receiver. The method may also include broadcasting a signal to a wide geographic area, wherein information in the signal is tagged to specific geographic locations. The system includes at least one receiver comprising a locator for self-determination of geographic location and a discriminator for extracting appropriate location specific information. The system may also include a base station for broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

Application Filing Date:
20030122

Summary of Invention Paragraph:
[0001] The present invention relates generally to providing wireless information related to a specific location, and more particularly, to providing location specific information to discriminating receivers located at a specific location.

Summary of Invention Paragraph:
[0002] Geographically related information such as weather, traffic, real estate listings, restaurant information, military weapons movement, base map upgrades, evacuation routes, and terrorist attack avoidance routes are among the types of information that may be delivered by wireless communication. Typically, however, this information needs to be tailored to specific geographic locations to be most useful to the receiver of the information. For example, anyone who is traveling by land, sea, air, by vehicle, or on foot requires geographic information to get from a starting point to their destination. This basic geographic information is available, for example, from a compass, a road atlas, or a chart. Electronic forms of geographic information are available from devices that indicate position, direction, velocity, and altitude. However, if additional information about a particular location is required, additional interaction is necessary. This is particularly inconvenient for the person engaged in operating a vehicle.

Summary of Invention Paragraph:
[0003] It is becoming increasingly common for individuals to carry various forms of devices for receiving such information. While a local radio broadcast is the most direct approach for transmitting localized information, hand held computing devices now allow individuals to receive and extract information available, for example, from the Internet. Such computer technology may take the form of a laptop computer

with a wireless receiving device or a wide area network (WAN) enabled PDA, e.g., a Palm Pilot.TM., that can receive Internet broadcasts. However, the computer technology cannot easily distinguish whether the broadcasts are for local geographic areas or for a remote geographic location. As a result, the user must analyze the broadcast to determine if the information is applicable to the users current geographic location.

Summary of Invention Paragraph:
[0004] It is known for a receiver, such as a PDA, to obtain location specific information from a localized broadcaster, provided the receiver includes a geographic positioning system. One such method is disclosed in U.S. Pat. No. 6,122,520 that describes a receiver for determining a present location, transmitting location coordinates to a network, and receiving location information corresponding to the transmitted location coordinates. The problem with this type of scheme for obtaining location specific information is that the receiver must include a transmitter to transmit the receiver's location to a provider of customized location information. As a result, the receiver needs additional circuitry to provide transmitting capability. In addition, the receiver needs to provide considerably more power to enable transmission of location coordinates to a network. Consequently, a mobile, handheld receiver for obtaining customized location information will suffer from reduced operating times and require more frequent recharging or battery replacement compared to a receiver--only device. Furthermore, in applications such as military operations, it may be important to use receivers that do not need to transmit to help avoid detection of a receiver's position. Accordingly, a receiver--only device can provide stealth advantages over more easily detected receive/transmit devices.

Summary of Invention Paragraph:
[0005] A tailored information delivery scheme using a one-to-one (network to single device) method, wherein each device requests information from the network, suffers from the drawback of requiring the network to deliver an individualized stream of information to each device within a service area. This is true even if the information being requested, such as geographically relevant information, is identical for multiple devices in the broadcast area, at the same point in time. This is a bandwidth expensive and inefficient method to accomplish the delivery of the individualized information. Therefore, there exists a need to inexpensively and efficiently deliver, using a passive, one to many topology (one network to many receivers simultaneously), geographic specific information to multiple receivers within a network. Such a scheme would allow better network resource allocation and therefore, would be much less expensive and bandwidth efficient to operate for the network.

Summary of Invention Paragraph:
[0006] Accordingly, a need exists for a method and system for receiving location specific information that does not require transmitting location information to a provider of the location specific information. In addition, a need exists for a system that allows a receiver to determine its location and reject or accept broadcasted location information based on the receiver's location. Further, there is a need for a system that can distinguish between geographically remote or geographically local information, and provide a user with information that is geographically oriented.

Summary of Invention Paragraph:
[0007] Generally, the present invention fulfills the foregoing needs by providing in one aspect thereof, a method of receiving location specific information including determining a location of a receiver. The method also includes self-determining a geographic location of a receiver. The method further includes receiving a signal comprising information pertaining to a wide geographical area. The method also includes selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific

information that only applies to a self-determined geographic location of the receiver. The method may also include broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

Summary of Invention Paragraph:

[0008] In another aspect thereof, the invention includes a system for receiving geographic location specific information. The system includes a receiving device for receiving a signal comprising information pertaining to a wide geographical area, wherein the information pertaining to a wide geographical area is transmit tagged according to specific geographic locations. The system further includes a locator, operably connected to the receiving device, for self-determining a geographic location of the receiving device and generating a receive tag corresponding to the geographic location of the receiving device. In addition, the system includes a discriminator, operably connected to the receiving device, for selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information having a transmit tag corresponding to the receive tag. The system may also include a base station for broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

Summary of Invention Paragraph:

[0009] The present invention further provides, in another aspect thereof, a data distribution system for receiving location specific information. The data distribution system includes a receiving device for receiving a signal comprising information pertaining to a wide geographical area, wherein the information pertaining to a wide geographical area is transmit tagged according to specific geographic locations. The system further includes a locator, operably connected to the receiving device, for self-determining a geographic location of the receiving device and generating a receive tag corresponding to the geographic location of the receiving device. In addition, the system also includes a discriminator, operably connected to the receiving device, for selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information having a transmit tag corresponding to the receive tag. The data distribution system may also include a base station for encoding geographic location specific information with transmit tags and broadcasting a signal comprising information pertaining to a wide geographical area comprising geographic location information tagged to geographic location specific information.

Brief Description of Drawings Paragraph:

[0013] FIG. 3 is a flow chart illustrating the method of delivering location specific information.

Brief Description of Drawings Paragraph:

[0015] FIG. 5 is a flow chart illustrating a detailed method of receiving location specific information.

Detail Description Paragraph:

[0017] FIG. 1 is a block diagram of an exemplary embodiment of the invention. Generally, the invention includes a base station 10, accessing information corresponding to specific locations culled from data sources 13 in a distributed network 14. The base station 10 can then provide the information to transmitters 15 broadcasting signals comprising location specific information to receivers 12. Advantageously, the information in the broadcast signal corresponding to a specific location is uniquely identified corresponding to a specific location for recognition by receivers 12 in the specific location. For example, a receiver 12 at a specific location will only process information uniquely identified as corresponding to the receiver's location. In an aspect of the invention, each receiver 12 includes a locator capable of independently determining the receiver's 12 location. For example, the locator may be a GPS receiver 18 for receiving

signals from global positioning satellites 16 to determine a receiver's global position. In another aspect, the locator may work in conjunction with wireless communication antennas operating in a configuration using triangulation, signal angle and/or time delays to mathematically determine a receiver's location, such as an E911 system or loran type system. The receiver 12 may also include a discriminator to extract location specific information corresponding to the location of the receiver 12, as determined by the locator. Accordingly, once the locator has determined the receiver's location, the receiver 12 can receive and process signals broadcast by the transmitter 15 to extract only the information from the signal corresponding to the receiver's 12 location. The information may then be geographically linked to the receiver's location and the information may be displayed, for example, by overlay on a GPS based map display. Advantageously, the invention eliminates the need for a receiver 12 to transmit the receiver's location to a base station 10, thus allowing the base station 10 to provide geographically tailored information with reduced power requirements and reduced complexity of the receiver 12. Further, elimination of a transmitter in the receiver 12 reduces the risk of device detection because the receiver 12 operates passively, without emitting signals that might be detected by locating devices. In addition, the invention provides for efficient use of the network resources by eliminating in the need for a base station 10 to keep track of receivers 12 in a broadcast area and provide individualized information to each of the receivers in the broadcast area.

Detail Description Paragraph:
[0018] FIG. 2 is a diagram of sector broadcasting, wherein the base station 10 provides information to transmitters 15 located in respective sectors for broadcasting location information tailored to a respective sector in a broadcast area. Accordingly, a broadcast area 20 may be divided into multiple sectors 22A-22D. In an aspect of the invention, a portion of the information may be simultaneously broadcast across all sectors of the broadcast area 20 and another portion of the information may be broadcast over a limited number of sectors. In an aspect of the invention depicted in FIG. 2, the base station 10 broadcasts information in sectors 22A-22D of a broadcast area 20. Only information corresponding to locations within a sector 22A-22D are broadcast to that sector. As a result, receiver 12 in sector 22A receives information corresponding to locations within sector 22A, while receiver 12 in sector 22B only receives information corresponding to locations within sector 22B. While only four sectors are depicted in FIG. 2, it should be understood that the number of sectors used are limited only by the broadcast beam shaping capabilities of the transmitter 15. It should be understood that the maximum size of the sector is dependent only on the size of the broadcast area 20 and a broadcast area 10 consists of one or more sectors. By broadcasting data in sectors, the bandwidth requirement for sending all the necessary information across the entire broadcast area is greatly reduced. The base station 10 can provide relatively smaller amounts of customized data for each sector, thereby conserving bandwidth for each sector broadcast, compared to broadcasting all appropriate data over the entire broadcast area 20. In addition, the processing requirements for the receivers 12 are reduced because the receivers 12 only need to process the information for the sector they are in, not processing all the information for the entire broadcast area 20.

Detail Description Paragraph:
[0019] FIG. 3 is a flow chart illustrating the method of delivering location specific information. The illustrated flow chart depicts the processes occurring in the base station 10, and each of the receivers 12 in communication with the base station 10 via transmitters 15. Initially, the base station 10 gathers information 24 corresponding to geographic locations within the base station's broadcast area 20. For example, the information may include roadmaps, traffic information, weather information, topographical maps, real estate listings, military troop movements, consumer pricing of goods and services or points of interest. The base station 10 may gather this information from a variety of sources, such as the Internet, geographic information system (GIS) databases, or National Oceanic and Atmospheric

Administration (NOAA) data, using, for example, a distributed network 14. The base station 10 processes the gathered information to determine the relevant information to be broadcast.

Detail Description Paragraph:
[0020] In an aspect of the invention, the information may be subdivided into corresponding geographic sectors of the broadcast area. For example, the sectors may include pie shaped areas emanating from the location of the base station 10, wherein a portion of the information pertinent to locations within a given sector are broadcast to that sector and a portion of the information which may need to be available to all locations is broadcast to the entire broadcast area 20.

Detail Description Paragraph:
[0021] Once the information is gathered, the base station 10 encodes the information 26 so that each receiver 12 can recognize the information in a broadcast that is specific to each receiver's location. In an aspect of the invention, the location specific information and data having global significance can be encapsulated in a "packetized" format and transmitted over a large coverage area. In an aspect of the invention, each data packet of information transmitted by the base station 10 via transmitter 15 may include a "header" which will include a variety of information tags in addition to the location specific information broadcast. For example, a packet header may include tags such as: a subscription tag to identify a subscriber; a data type tag to identify the type of data in the packet; an authorization tag to validate and unlock a paid subscription; a security tag; a service level tag to identify the amount of information the receiver is authorized to accept; a delta tag to indicate the information is new or different information; a time stamp to indicate when the data was sent or the validation period; a sweep tag to identify the sweep number of the information being broadcast; a relevant location grid tag to identify the location; grid and sector for which the data is intended; and a unique device identifying code that allows data to be sent to a specific receiver so that the information can be easily recognized and processed by a receiver 12. For example, Internet-based information broadcast by a base station 10 via transmitter 15 may be provided with a header that can be analyzed by a receiving device to determine whether the broadcast information is for a remote or local application based on the present location of the receiver 12. Accordingly, the receiver 12 can quickly and efficiently distinguish between geographically remote or geographically local information in a broadcast, instead of having to process all the broadcast information received. Thus, the receiver can efficiently provide the user with information that is geographically appropriate by interpreting the header and tags.

Detail Description Paragraph:
[0022] In another aspect of the invention, the information may be encoded using a unique identifying tag, such as a transmit tag unique to a receiver. The base station 10 encodes information with the transmit tag according to the specific receiver for which the information is intended. For example, receiver 12, for which service subscription renewals have been paid, is contacted and provided a unique algorithmic authorization code to reset the receiver 12, so that the receiver 12 can begin processing, for example, all the information or a subset of the information based on the level of information service paid for. The tag may only be valid for a predetermined geographic location or a preset time period. If the receiver moves out of the predetermined geographic area, the receiver is unable to extract information. Similarly, if a subscriber's subscription to the service runs out, the receiver will no longer be able to extract information because the tag is no longer valid. In another aspect, the receiver 12 can receive information for a preset geographic area or based on a period of time or until another unique algorithmic authorization code is sent to terminate or modify the service. For example, a receiver 12 may be assigned a receive tag uniquely associated with the receiver 12. When the receiver 12 receives a signal with information having a transmit tag corresponding to the receiver's receive tag, that information is

processed. As a result, a receiver 12 recognizes information tagged for the receiver 12 and ignores information not tagged for the receiver 12. Accordingly, unwanted information is quickly culled from the broadcast, leaving only the desired information to be processed.

Detail Description Paragraph:
[0025] In an aspect of the invention as shown in FIG. 4, a centralized network operations center (NOC) performs the task of gathering data and distributing the data to individual base stations. In one aspect, the data that is received by the network operations center is relative to a location, for example, a weather radar sweep for the state of Florida, wherein the center of the sweep and the radius of the sweep are known, so that the relevant location and area of the sweep is known. In another aspect, the data is tagged with a street address or other locations. With location specific advertising, for example, a particular restaurant may want potential patrons within a certain driving radius to be notified about the restaurant's special of the day.

Detail Description Paragraph:
[0026] The NOC computers compile data from the network in real-time and create a "big picture" view of the data. Then the data is formatted, including the location information, in a packetized format for delivery to individual base stations and broadcast, via transmitters, to the appropriate receivers in the broadcast area. In one aspect of the invention, only base stations relevant to the data are utilized. For example, information about the lunch special in a San Jose, Calif. restaurant would not be provided to a base station that covers Orlando, Fla. Similarly, traffic alert data for Oregon may not be provided to base stations broadcasting in New York. However, in another aspect, some, or all, information may be made available to all receivers in the broadcast area. For example, if a user located in Orlando, Fla. wanted the weather in San Jose, Calif., that information can be provided. In an embodiment, the NOC will broadcast the entire nation on a sweep basis and the receiver can accept this information and display it as requested. The Orlando user, for example, can place a cursor over San Jose, Calif. on the map display and the device will detect and filter the broadcast data to extract the appropriate information for San Jose, Calif. In this manner, a user is able to view, for example, weather conditions for any location broadcast by the NOC.

Detail Description Paragraph:
[0028] Another aspect of the invention is a user defined list of "favorite places" where the user may preset a list of geographic locations in memory. The receiver may incorporate multiple filters, running in a background mode, for simultaneously collecting detailed information on the selected favorite places. When the user selects one of these favorite places, the information corresponding to the selection is displayed without delay which would otherwise be inherent in waiting for the information sweep to deliver the information.

Detail Description Paragraph:
[0029] In yet another aspect, the invention may store historical information in memory, so that the user may replay that information for display on display screen of the receiver. The receiver may store location specific weather information so that storm movement can be tracked and displayed, for example, overlaid on a map display. Weather information for a specific geographic location may be stored over an extended time period so that the stored data may be "replayed" to graphically display the progress of a storm over time, shown in a replay mode.

Detail Description Paragraph:
[0031] Turning now to the receiving process, receivers 12 in the broadcast area initially determine their geographic location 30 in the broadcast area. For example, the receivers 12 may be GPS enabled or incorporate E911 locator capability, such as in a cellular or PCS system, to provide location sensing. In another aspect of the invention, a user may program a desired location into the

receiver 12 to enable receiving information corresponding to the programmed location. After the receiver's 12 location is determined 26, the receiver 12 receives information 32 from the base station 10. The received information is then discriminated 34, such as by analyzing tags attached to the information, to determine the location information specific to the receiver's 12 location. For example, the receiver 12 may read the header information of the broadcast information to determine which data in the broadcast is intended for the receiver's current location. In another aspect, the receiver may reject any broadcast not tagged for the current location of the receiver 12, and accept only the information that is tagged for the current location.

Detail Description Paragraph:
[0032] After the broadcast information is discriminated, the location specific information corresponding to the receiver's current location is extracted and processed 36 to display relevant information corresponding to the receiver's 12 location. For example, the system may process all the sector information in close proximity to the receiver 12 and less sector information farther away from the current location of the receiver 12, thereby providing a high level of detail in the local area, and less detailed information farther away from the device. The receiver 12 may also limit the information processed based on a viewing scale selected by a user. Once the information is processed, the receiver 12 returns to the step of determining the receiver's location 30 and the process is repeated.

Detail Description Paragraph:
[0033] FIG. 5 is a flow chart illustrating a more detailed method of receiving location specific information. The process starts 40 when the receiver is activated by a user. Once the receiver is activated, the processes of receiving 32, processing 38, and user interfacing 58 can occur in parallel. The receiving process 32 acquires data broadcast from the base unit 33, and continues to acquire data as long as data is available 34. Concurrently, the data packets in the in the broadcast are received 36 and the received packets passed to a discrimination step 44 in the processing 38 flow.

Detail Description Paragraph:
[0034] The processing flow 38 starts by determining the receiver's location 40 and updating the current location for enabling discrimination 42 of incoming information. The received information (for example, in the form of data packets) from the receiving process 32 is discriminated 44 to determine if the incoming data is relevant 46 to the receiver's current location, or for example, to a selected location. If the data is not relevant, the information is discarded 48. If the data is relevant, the data is processed for display 50 or other indication, such as audible instructions. Concurrently, the data is stored (for example in non-volatile RAM) for future reference 52. Data stored in this manner may allow "instant zooming" of the display without having to reacquire information. The receiver then enters a standby mode 54 until the display (or oral indication) needs updating 56. After the display is updated, the process returns to determining the receiver's location in step 40 step.

Detail Description Paragraph:
[0035] During the receiving and processing processes, the user may control the receiver functions in the user interfacing 58 process, wherein a user selects display parameters 60, such as zoom features, and the receiver updates the display parameters 62 and continues to monitor user inputs. The selected display parameters are then processed 64 and provided to the discrimination step 44 in the processing flow 38, so that the receiver can discriminate according to the selected parameters, such as the current zoom or specific desired data. For example, a user may only want to view road map data along with traffic advisories. Conversely, the user may only want to view nautical chart data with the weather radar and climate information displayed. Manually selectable zooming capability allows a user to automatically scale the amount of processing required. In an aspect of the

invention, a coarse view will always be accepted to allow the receiver to have
something to be displayed. In another aspect of the invention, received data may be
overlaid on a display or provided in a separate window portion or a linked screen
of the receiver display. In another embodiment, the information may also be page-
linked so the user can simply "page" through the relevant groups of information,
analogous to changing channels on a TV. Each page can be set based on the zoom
setting. For example, local residential real estate listings can be provided on one
page, commercial real estate listings on another, and weather on yet another page.
Each page may be overlaid on a base map for of ease of location reference.

Detail Description Paragraph:
[0036] All data receiving and processing will occur automatically. "Hand offs" from
one base station to another base station are performed without operator
intervention. As a user travels across the country, the user's location, and all
relevant data, will be available and updated according to the user's current
location.

Detail Description Paragraph:
[0037] Exemplary embodiments of the invention will now be described. To provide
self-locating capabilities, the receiver may employ locating techniques such as
GPS, Loran, Inertial Navigation, Direction Finding systems, or the like. In one
embodiment, the invention is a wireless network including receivers that
incorporate GPS capabilities, and such as PDAs, handheld computers or laptops. The
receivers may also include cellular phones incorporating a E911 location
capability. The receivers can be hand-held or mounted in a vehicle such as a boat,
auto, farm equipment, golf cart, airplane, or the like, to receive the information.
The received information will allow the user to view (or Filter) the relevant
information at the location of the receiver. Alternately, the user can program the
receiver for another location to receive information for that location.

Detail Description Paragraph:
[0038] The appropriate location specific information is collected from various
sources and transmitted to the device via a wireless network. For example, over the
air communication may include: satellite communications via a traditional
communication link, traditional wireless communication technologies, such as WAN
technologies; paging networks, either satellite or ground based; and cellular
networks, such as PCS or analog systems, FM or other radio signals, satellite radio
or a WiFi network. In geographically remote locations, satellite-based circuitry,
such as within the Iridium System may be used.

Detail Description Paragraph:
[0039] As an example, an existing paging system offers one of the least expensive
backbones for the current invention. Advantages to using existing paging
infrastructure to implement the invention include lower cost circuitry, lower
delivery cost, and smaller antenna requirements. Each paging device typically
incorporates a unique Capcode or tag that allows the pager to "hear" or filter only
those pages intended for the pager with that matching Capcode. All pagers in the
area of the message broadcast actually receive the page, but in the case where the
Capcode doesn't match a pager's unique Capcode, the pager does not process the
page. This type of system may be used to implement the current invention by
incorporating a header that may contain tags including a location tag in
replacement of the Capcode.

Detail Description Paragraph:
[0040] For example, weather information may be parsed, packetized, and assigned a
header with a location tag instead of a Capcode. The paging network or base
station, would broadcast this information as a page, such as in the form of page
including a header, with a location tag replacing the Capcode, and the weather data
for that location.

Detail Description Paragraph:
[0041] The paging network may broadcast this information sector by sector while sweeping over the entire broadcast area. The broadcast cycle may also vary based on the underlying weather conditions. The receivers may process the pages based on the header tag identifying the sector that are appropriate to each receiver's current location. The receiver identifies its location, for example, from a connected GPS device. The weather-related information may provide a graphical real-time display of a weather radar scan for a particular geographic area, a weather forecast for a specific area, real estate listings, geographically relevant product and service advertisements or other geographically relevant information. Accordingly, the receiver culls inappropriate information and processes sector specific information corresponding to the receiver's sector location in the broadcast area.

Detail Description Paragraph:
[0042] In an embodiment, the receivers may process all the sectors in close proximity to the receiver and fewer sectors farther away from the current location of the receiver, thereby allowing a high level of detail in the local area and less detail farther away from the current location of the receiver. In another embodiment, the self-determining capability may be overridden to allow input of a desired geographic location. Accordingly, a desired geographic location can be selected and the receiver will extract the appropriate geographic location specific information corresponding to the selected location from a broadcast signal. For example, a user in one location may be able to override that self-determined location and retrieve geographic specific location information for different desired location by inputting the desired location in the receiver. The receiver then receives a broadcast containing geographic specific information for the desired location, extracts the information, and then displays the graphical weather radar sweep or other geographical relevant information, such as by overlaying the information onto a GPS map. For example, a user in one city may be traveling to a destination city 30 miles away and may wish to see information related to the destination city. By inputting the desired destination location, the information for that city is received, extracted, and displayed. In one embodiment, the information may be synchronized to the location of the user so that as the user drives towards the destination city, the information is updated appropriately.

Detail Description Paragraph:
[0043] In another aspect of the invention, security algorithms may be used to prevent unauthorized monitoring of the broadcast information. In yet another aspect, location appropriate location information may be overlaid on a display of the receiver, or displayed on a separate page, but still linked to the receiver's actual or programmed location. In still another aspect, two-way communication may also be provided in the receiver to allow transmitting of information.

Detail Description Paragraph:
[0044] Furthermore, advertising may be included with the information and, in particular, location specific advertising such as for restaurants or shopping. The location specific information can be coupled with "coupons" or advertised specials based on time and location of the merchants. "Cheap gas" could be displayed for a cross country venture so that the relative cheapest price of gasoline in a 50 mile radius is displayed for the intended route to allow the traveler ample time to take advantage of the appropriate exit to get the best deal. The invention may automatically provide a continuously updated route to the nearest cheapest gas.

Detail Description Paragraph:
[0045] In yet another aspect of the invention, map displays on the receiver are updated automatically whenever information for a specific geographic location is received and extracted. Accordingly, this dynamic updating obviates the need for maintaining maps, such as by DVD or removable memory device, in the receiver. Updates are provided automatically as updated information is broadcast to the receiver.

CLAIMS:

1. A method of receiving location specific information comprising: self-determining a geographic location of a receiver; receiving a signal comprising information pertaining to a wide geographical area; and selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information that only applies to a self-determined geographic location of the receiver.

2. The method of claim 1, further comprising receiving a signal wherein geographic location specific information within the information pertaining to a wide geographic area is tagged to identify respective geographic locations.

3. The method of claim 2, further comprising discriminating the signal comprising information pertaining to a wide geographical area according to the self-determined geographic location of the receiver and an assigned tag.

4. The method of claim 1, further comprising distinguishing between geographic location specific information that is geographically remote, and geographic location specific information that is geographically local to the self-determined location of the receiver.

5. The method of claim 1, further comprising processing the information pertaining to a wide geographical area to extract geographic location specific information associated with the self-determined geographic location according to a selected viewing scale.

6. The method of claim 1, further comprising: overriding a self-determined geographic location of a receiver; and accepting a desired geographic location input to allow receiving and extracting of geographic location specific information corresponding to the desired geographic location input.

7. The method of claim 6, further comprising selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information that only applies to a desired geographic location input.

8. The method of claim 7, further comprising processing the information pertaining to a wide geographical area to extract geographic location specific information associated with the desired geographic location input according to a selected viewing scale.

9. The method of claim 1, further comprising receiving and extracting advertising information linked to a specific location in the signal comprising location specific information.

11. The method of claim 1, further comprising receiving and extracting updated geographic location specific information to continually refresh previously stored geographic location specific information.

12. The method of claim 11, further comprising receiving and extracting updated geographic location specific information for a plurality of selected locations to continually refresh previously stored geographic location specific information for each of the respective selected locations.

13. The method of claim 1, further comprising storing extracted geographic location specific information to allow selective replay of the extracted geographic location specific information.

14. The method of claim 1, further comprising overlaying geographic location specific information extracted from the signal comprising information pertaining to a wide geographic area on a receiver map display corresponding to a self-determined geographic location of a receiver.

15. The method of claim 1, further comprising gathering information related to specific geographic locations.

16. The method of claim 1 further comprising broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

17. The method of claim 16, further comprising distributing information related to specific geographic locations in a wide geographical broadcast area to at least one transmitter broadcasting in the corresponding wide geographical broadcast area.

18. The method of claim 16, further comprising assigning tags, identifying a respective geographic location, to the geographic location specific information within the information pertaining to a wide geographic area.

19. The method of claim 16, wherein the tags are only valid for a predetermined geographic location.

21. The method of claim 16, further comprising including advertising information linked to a specific geographic location in the signal comprising information pertaining to a wide geographic.

23. The method of claim 1, further comprising broadcasting, to a respective geographic sector of a wide geographical broadcast area, only geographic location specific information corresponding to the respective geographic sector.

24. The method of claim 23, further comprising assigning tags, identifying a respective geographic location, to the geographic location specific information corresponding to the respective geographic sector.

25. The method of claim 1, further comprising subdividing information related to geographic locations and broadcasting subdivided information simultaneously on separate transmission channels.

26. The method of claim 25, wherein the subdivided information broadcast on a respective transmission channel is updated at a different rate than information simultaneously broadcast on a different channel.

27. A system for delivering location specific information comprising: a receiver for receiving a signal comprising information pertaining to a wide geographical area; a locator, operably connected to the receiver, for self-determining a geographic location of the receiver; and a discriminator, operably connected to the receiver, for selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information that only applies to a self-determined geographic location of the receiver.

28. The system of claim 27, wherein the locator is a GPS receiver.

29. The system of claim 27, further comprising an override to allow input of a desired geographic location input for extracting geographic location specific information corresponding to the desired geographic location input.

30. The system of claim 27, further comprising a base station for broadcasting a signal comprising information pertaining to a wide geographic area, wherein the information comprises geographic location specific information.

31. The system of claim 30 wherein the base station further comprises an encoder for assigning tags, to identify geographic location specific information in the signal comprising information pertaining to a wide geographic area.

32. The system of claim 27, further comprising a centralized network operations center for gathering geographic location specific information for a wide geographic area and distributing the information to at least one base station broadcasting to a respective wide geographic area.

33. A data distribution system for receiving geographic location specific information comprising: a receiving device for receiving a signal comprising information pertaining to a wide geographical area, wherein the information pertaining to a wide geographical area is transmit tagged according to specific geographic locations; a locator, operably connected to the receiving device, for self-determining a geographic location of the receiving device and generating a receive tag corresponding to the geographic location of the receiving device; and a discriminator, operably connected to the receiving device, for selectively extracting, from the signal comprising information pertaining to a wide geographical area, geographic location specific information having a transmit tag corresponding to the receive tag.

34. The data distribution system of claim 33, wherein the locator changes the receive tag according to a self-determined location of the receiving device.

36. The system of claim 33, further comprising an override to allow input of a desired geographic location input for extracting geographic location specific information corresponding to the desired geographic location input.

37. The data distribution system of claim 33, further comprising a base station for encoding geographic location specific information with transmit tags and broadcasting a signal comprising information pertaining to a wide geographical area comprising geographic location information tagged to geographic location specific information.

Previous Doc Next Doc Go to Doc#

SHOW FILES
File 148:Gale Group Trade & Industry DB 1976-2005/May 16
(c)2005 The Gale Group
File 180:Federal Register 1985-2005/May 13
(c) 2005 format only The DIALOG Corp
File 624:McGraw-Hill Publications 1985-2005/May 12
(c) 2005 McGraw-Hill Co. Inc
File 649:Gale Group Newswire ASAP(TM) 2005/May 05
(c) 2005 The Gale Group
File 813:PR Newswire 1987-1999/Apr 30
(c) 1999 PR Newswire Association Inc
?

Set	Items	Description
S1	6	GPS AND (DIFFERENTIAL? (W) INFORMATION) AND LOCATION? AI DISPLAY?
S2	4	RD (unique items)

?

T S2/3,KWIC/1-4

2/3,KWIC/1 (Item 1 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2005 The Gale Group. All rts. reserv.

07800344 SUPPLIER NUMBER: 16811134 (USE FORMAT 7 OR 9 FOR FULL
TECHNOLOGICAL BREAKTHROUGH IN SATELLITE POSITIONING BY SATLO(
MAJOR BENEFITS FOR AGRICULTURE, AVIATION AND OTHER INDUSTRIES
PR Newswire, p413LA037
April 13, 1995
LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 1267 LINE COUNT: 00108

... company specializing in non-military uses of the Department of Defense's Global Positioning System (GPS), today announced it has developed trend-setting breakthrough technology that will have major implications for...

...units, fire trucks and ambulances.
The SATLOC SSD provides precise correction data for the 24 GPS satellites which are orbiting the earth to give instant latitude, longitude and altitude coordinates by...

...based positioning system in 1986 and now operates its own proprietary nationwide OMNISTAR(TM) differential GPS network.)
Not to be confused with conventional radio towers, each of the JECA ground stations calculates differential information which is relevant to the area where the reference station is located. The information is...

...flashed to SATLOC SSD equipment in aircraft or in ground vehicles. The use of the differential information overcomes timing variances purposely introduced by government satellites which can lead to position errors of...

...beginning in Bakersfield, Calif., and ending 13 days later near Greenville, N.C. (Dates and locations are listed below.) The plane, a single-engine Ayers Turbo Thrush, will be piloted by...

...before seen. Without benefit of maps or local landmarks, Goodwin will be guided to each location by SATLOC AirStar and SSD equipment. With the appropriate longitude and latitude coordinates preprogrammed into...

...to each field but he will know when he is entering each field. A

lightbar display forward of his windshield will flash precise steering instructions so that Goodwin's aerial applications...

...pilot and IBM executive who worked on the Gemini/Apollo missions with NASA, added: "The GPS system is one of the great bargains the U.S. taxpayer has ever had. What...

2/3,KWIC/2 (Item 1 from file: 180)
DIALOG(R)File 180:Federal Register
(c) 2005 format only The DIALOG Corp. All rts. reserv.

DIALOG Accession Number: 03071833 Supplier Number: 66093133
Department Regulatory Agenda; Semiannual Summary
Volume: 66 Issue: 93 Page: 25755
CITATION NUMBER: 66 FR 25755
Date: Monday, May 14, 2001

TEXT:
...277Domestic and foreign trade; interpretations

46 CFR 280Limitations on the award and payment of operating- differential subsidy for liner operators

46 CFR 281Information and procedure required under liner operating-differential subsidy...U.S. Coast Guard--
Prerule Stage

Sequence Number	Title	Regulation Identification Number
2075	Electronic Chart Display and Information System (ECDIS) (USCG-2001-8826)	2115-AG09

U.S. Coast Guard--
Proposed Rule...Drivers

2302	Parts and Accessories Necessary for Safe Operation; Television Receivers and Data Display Units	2126-AA19
2303	Motor Carrier Replacement Information/Registration System	2126-AA22
2304	Revision of Regulations and...Reporting Requirements for	2127-AI07

October 2001
2387 Reorganize and Harmonize Controls 2127-AI09
and Displays
2388 Confidential Business Information 2127-AI13
2389 "Early Warning" Defect Reporting 2127-AI25
Requirements
2390...2492 Determination of Minimum Testing 2130-AB31
Rate for Random Drug and Alcohol
Testing
2493 Locational Requirement for 2130-AB38
Dispatching of United States Rail DOT-designated
Operations significant
regulation

Federal...Stage

Sequence Number	Title	Regulation Identification Number
2517	Maps and Records of Pipeline Locations and Characteristics; Notification of State Agencies; Pipe Inventory	2137-AB48
2518	Hazardous Materials: Revision of	2137-AD18...America

petitioned the CAB to simplify its counter- sign requirements. Presently, airlines are required to display four different consumer protection notices on their ticket counters. The petitioners alleged that the current ...Rin: 2105-AC82

Prerule Stage

U.S. Coast Guard (USCG)
Prerule Stage

2075. * ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (EC
(USCG-2001-8826)

Priority: Substantive, Nonsignificant

Legal Authority: 33 USC 1223...

... This rulemaking would allow commercial vessels the option of using an IMO approved Electronic Charting Display and Information System (ECDIS) as a primary means of navigation in U.S. waters in...few hours to a few

days. Safety zones are established for events such as fireworks displays , high speed races, or the transit of dangerous cargoes such as explosives or liquefied petroleum...

... areas are areas in which vessels of not more than 65 feet may anchor without displaying the required lights or sound signals. These special anchorage areas are limited geographically, and depending...response plan. The regulations would apply to marine transportation- related facilities that, because of their location , could cause harm to the environment by discharging a hazardous substance into or on the...these areas. In return, the mariners are provided with automated information about the last known locations of any right whales. This project supports the Coast Guard's strategic goal of protecting...ILS) and the microwave landing system (MLS) during the transition to the global positioning system (GPS). The policy statement of December 1989 announced the transition from the ILS to the MLS for precision approach service in the National Airspace System. Since that time, advancement of GPS -based landing system technology has provided a more economical means of providing approach services.

Timetable...for in- flight collision with a bird, including the size of the bird and the location of the impact on the airplane. These changes are intended to harmonize the bird strike...dates. The FAA believes that newly manufactured chemical oxygen generators might be manufactured in one location and transported to another location to be filled. This could lead to human factors errors in determining whether the device...

2/3,KWIC/3 (Item 2 from file: 180)
DIALOG(R)File 180:Federal Register
(c) 2005 format only The DIALOG Corp. All rts. reserv.

DIALOG Accession Number: 02399123 Supplier Number: 960302699
Export Administration Regulation; Simplification of Export Administration Regulations
Volume: 61 Issue: 58 Page: 12714
CITATION NUMBER: 61 FR 12714
Date: MONDAY, MARCH 25, 1996

TEXT:
... a more descriptive cross-reference to part 742 and is placed in a more appropriate location .

A few commenters expressed confusion over the use of UN Column 1. This interim rule... information subject to the requirements of the Paperwork

Reduction Act unless that collection of information displays a currently valid OMB Control Number. This interim rule contains five new collections of information... programs offered by BXA, is available from the Office of Exporter Services at the following locations :

Exporter Counselling Division, U.S. Department of Commerce, 14th and Pennsylvania Avenue, N.W., Room... of section 3506(c)(1)(B)(i) of the Paperwork Reduction Act requiring agencies to display current control numbers assigned by the Director of OMB for each agency information collection requirement...754 of the EAR concerning short supply controls is self-contained and is the only location in the EAR that contains both the prohibitions and exceptions applicable to short supply controls...754 of the EAR concerning short supply controls is self-contained and is the only location in the EAR for both the prohibitions and exceptions applicable to short supply controls.

(j... Exception includes the export of items moving in transit through the United States, imported for display at a U.S. exhibition or trade fair, returned because unwanted, or returned because refused...Entry and Manifest of Goods Subject to Customs Inspection and Permit."

(2) Items imported for display at U.S. exhibitions or trade fairs. Subject to the following conditions, License Exception TUS authorizes the export of items that were imported into the United States for display at an exhibition or trade fair and were either entered under bond or permitted temporary...

2/3,KWIC/4 (Item 1 from file: 624)
DIALOG(R)File 624:McGraw-Hill Publications
(c) 2005 McGraw-Hill Co. Inc. All rts. reserv.

0662142
SYSTEM USES GPS TO GUIDE SPRAYING
EDWARD H. PHILLIPS
Aviation Week & Space Technology, Vol. 142, No. 20, Pg 39
May 15, 1995
JOURNAL CODE: AW
SECTION HEADING: AIR TRANSPORT ISSN: 0005-2175
WORD COUNT: 469

SYSTEM USES GPS TO GUIDE SPRAYING

TEXT:

An Arizona company is introducing a system that will use differential GPS to guide spraying operations of agricultural aircraft.

Tempe, Ariz.-based Satloc specializes in developing commercial...

... the AirStar system's navigation capabilities further, Satloc last month completed development of a differential GPS system that will guide pilots to ``a field they have never seen before" and allow...

...Hartt.

A series of 11 ground-based reference stations has been permanently installed at strategic locations across the northern and southern perimeters of the U.S. to provide corrected signals. These...

... Chance & Associates of Lafayette, La., which provides precision surveying and positioning services.

Each station computes differential information relevant to its own geographic area and sends the correction data via ground lines to...

...the receiver can reacquire the signal within 2-5 sec.

AN ON-BOARD, 12-CHANNEL GPS unit updates the aircraft's position five times per second. A digital display installed forward of the windscreen provides ground speed, track, cross-track error, acres per pass...

...the field, altitude, heading and angle of intercept information.

When a swath is completed, the display tells the pilot which direction to turn for the next pass and ensures each swath...
?